the tool engineer

OCTOBER 1956

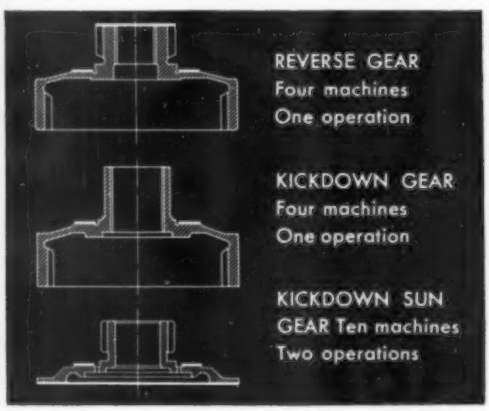
gear shaving

PUBLICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS

Heald **VERSATILITY** *in action*

How STANDARD Rotary Surface Grinders do a PRODUCTION-LINE JOB

Eighteen Model 261s surface grind 3 different automatic transmission parts on a high-production basis



PRODUCTION-LINE speed and tool-room precision go hand-in-hand on a Heald Model 261 Rotary. Its automatic features make it an ideal machine for long runs of identical parts. This is well illustrated by an 18-unit lineup of 261s in a fast-moving production line at a large automatic transmission plant. These *standard machines* are surface grinding the three different gears shown at the left. All 18 machines have 12" chucks and magnetic workholding is used for all but one of the operations. The number of machines used for each operation depends on grinding time per part and required hourly production. There are 15 *other* Model 261s in this same plant, doing both *production-line* and *tool-room* work.

Available as either a Plain or Automatic cycle machine, the Heald 261 easily meets every requirement for long or short run rotary surface grinding work. For complete information, send for Bulletin No. 2–261–2, Issue 3.

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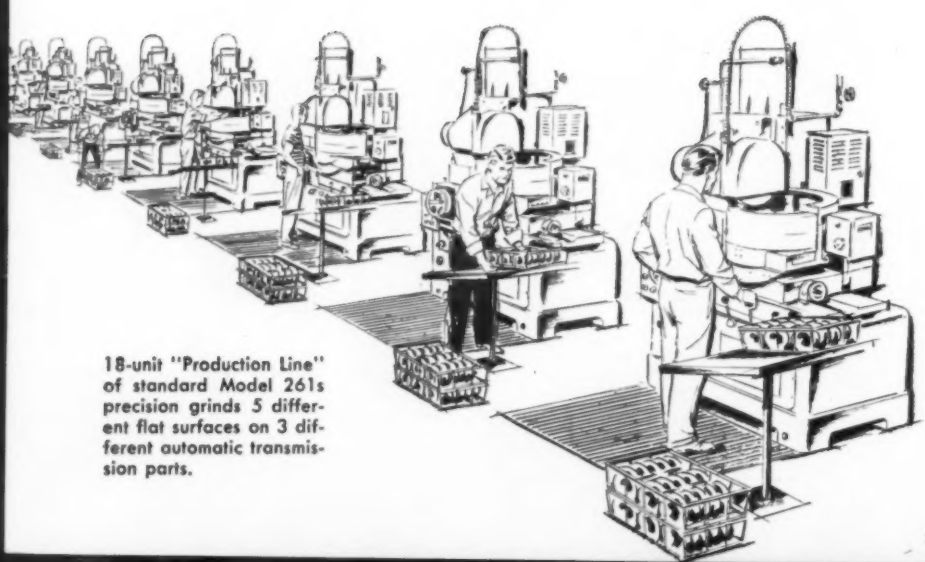
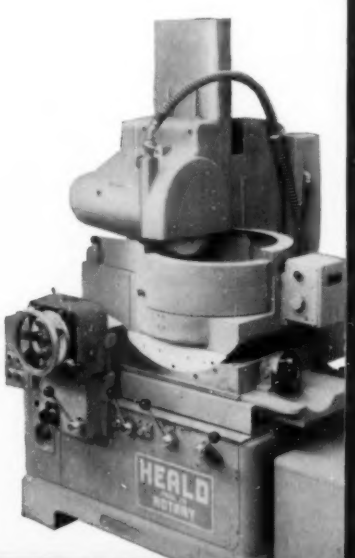
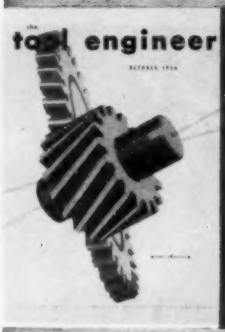


18-unit "Production Line" of standard Model 261s precision grinds 5 different flat surfaces on 3 different automatic transmission parts.



COVER: Typical rotary gear shaving operation processing a small gear. Carefully planned tooling programs can improve gear quality and reduce tool costs. The article beginning on page 103 discusses gear shaving operations and methods for securing optimum performance.



The Tool Engineer

Volume XXXVII, No. 4 October, 1956

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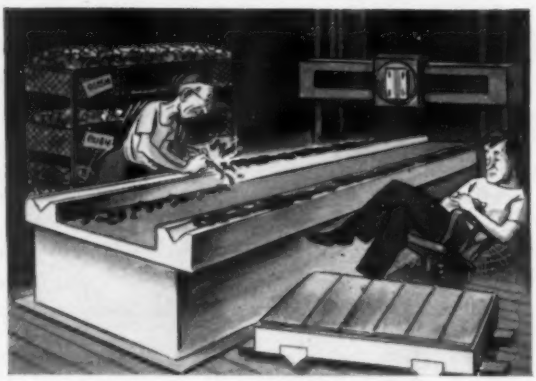

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The **Tool Engineer**

Can We Make It?

As time marches on, the provinces of design and tool engineering move closer together. The interdependence of these two major functions has been dramatically highlighted with the advent of large capital investments in automatic and integrated production machines. Although products must be designed in accordance with good design principles, before designs are frozen, they should be cost checked with an eye toward available production equipment.

Liaison between design and production personnel is increasing in amount and in importance. The right time for such liaison is getting earlier in the design procedure. There is no more point in designing a product that can't be made economically than there is in designing one that won't work.

Another mutual-interest area that has perhaps been overlooked too long is in the field of materials selection. Designers are basically concerned with the selection of materials in terms of physical and mechanical properties. To satisfy the needs of a particular application, the designer will frequently specify the material form—casting, sheet, tube, rod, forging, etc—but usually only with regard to the particular properties evidenced by the materials in that form.

The tool engineer should exert more influence in the earlier stages of materials selection because equivalent properties can be achieved in many ways but with a wide variation in manufacturing expense. Since the tool engineer has wide experience in determining costs for working the various materials in all their forms, the more influence he has on materials selection, the better will be the product cost picture.

Regardless of the materials specified, however, the tool engineer must be able to work them economically. For this reason, tool engineers must keep informed on new materials so they can be worked when they are specified. Also, each time a new process is introduced, the tool engineer should evaluate it in terms of all materials.

Close liaison between design and production, and tool engineers steeped in materials processing experience will mean that if a product can be made of any material, the tool engineer will be able to make it of the specified material.

Robert A. Wason

ASSOCIATE EDITOR

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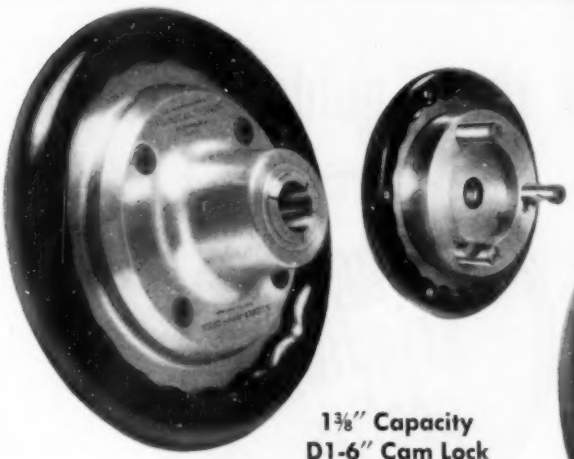

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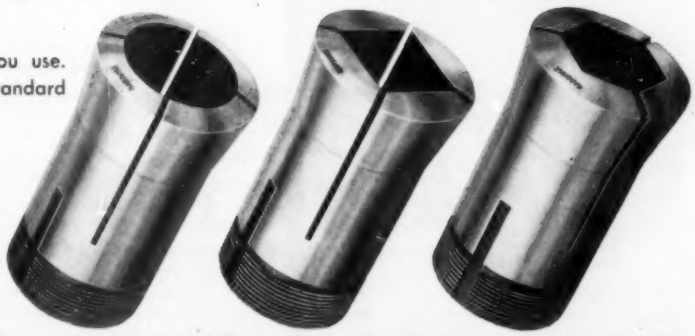

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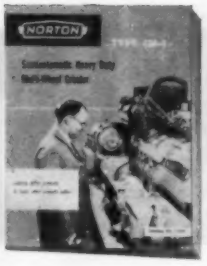

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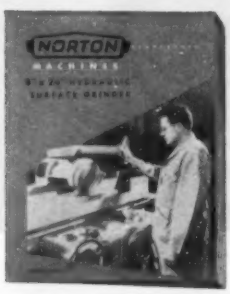

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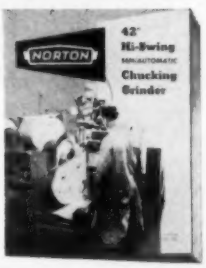

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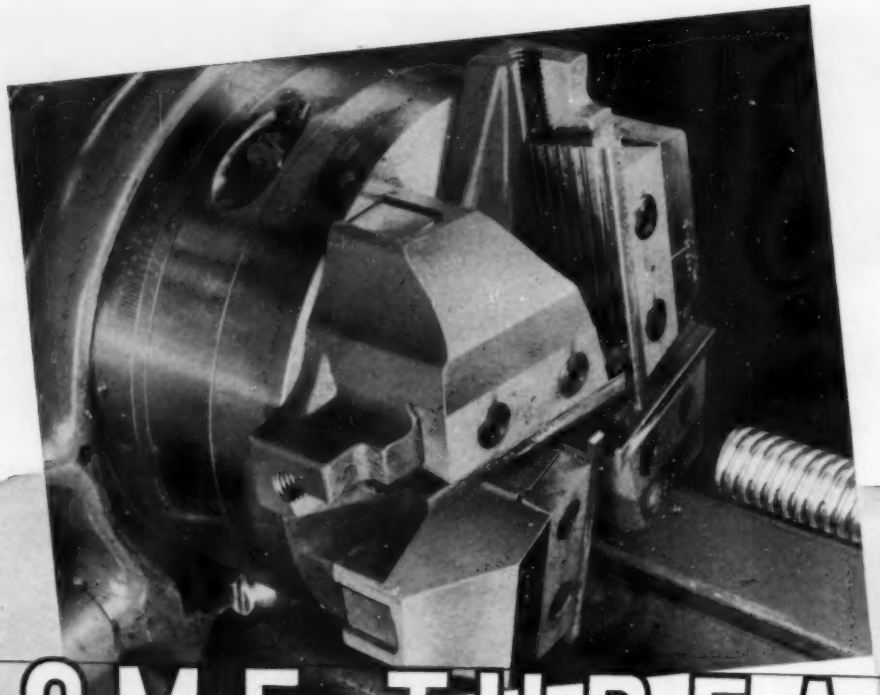

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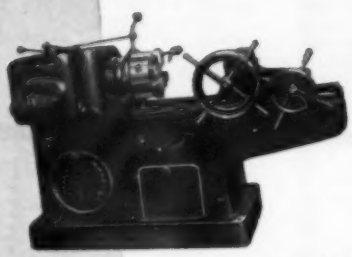

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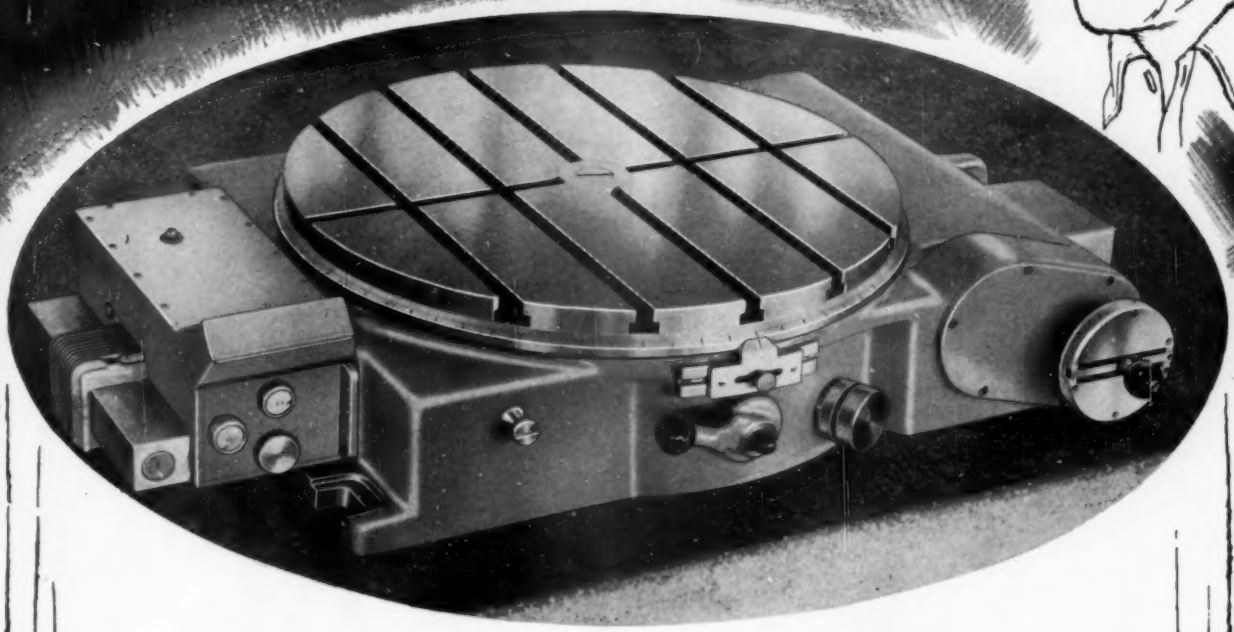

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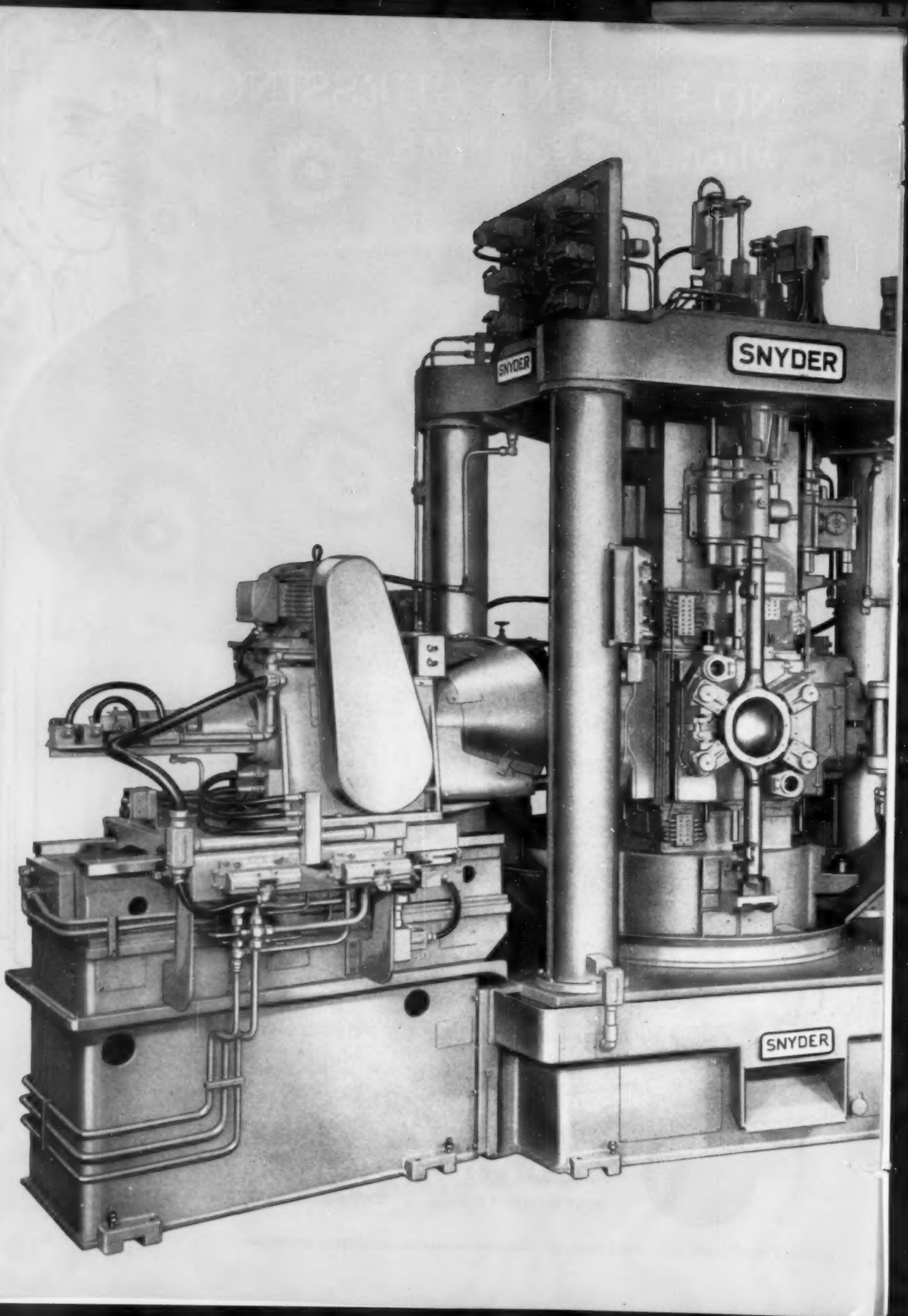
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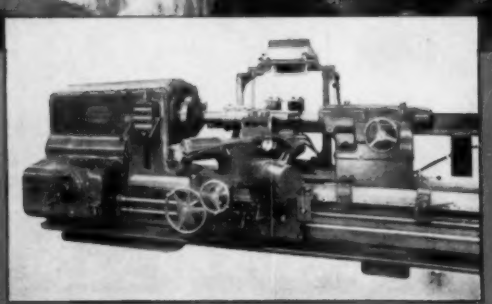

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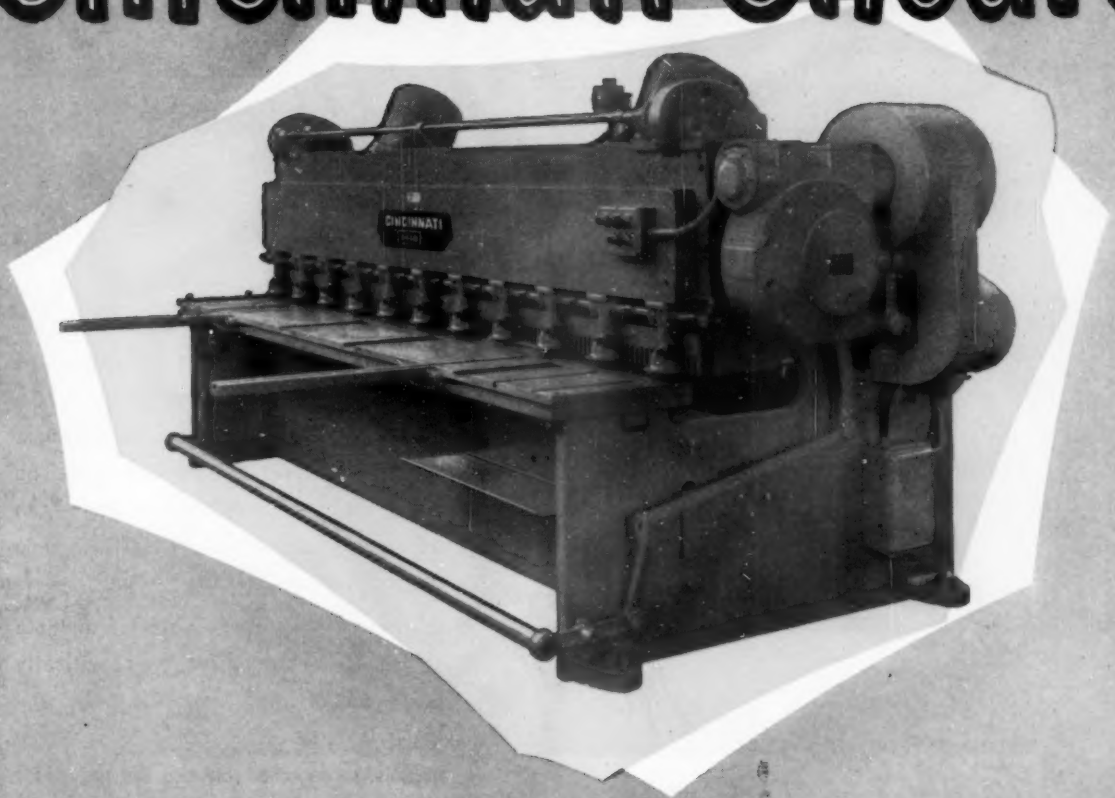

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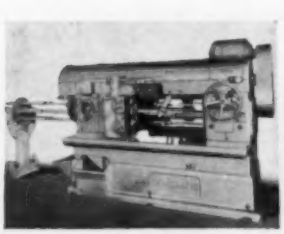
61 models

A machine not put to its best use is theoretically idle. Proper machine selection is an important factor in the profitable use of a multiple spindle automatic. So extensive are the demands on this type of lathe that no single model—or number of models—can be expected to efficiently handle the wide range of work available.

To excel in any range of work a multiple spindle automatic must be specifically designed for that range. That is why CONOMATICS are provided in so many models. In no other way can the purchaser be assured of the best possible machine for his particular requirements.

Write for your copy Today



Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U. S. A.

Drill and cut with accuracy . . .

hold with a *Jacobs* CHUCK

Jacobs and your industrial supply distributor are ready to deliver the chucks you need and the service you deserve. First in chucks . . . first in service.

THE JACOBS MANUFACTURING COMPANY • WEST HARTFORD, CONNECTICUT

New Style KSDN Kendex Tool designed for turning, profiling and chamfering in either direction

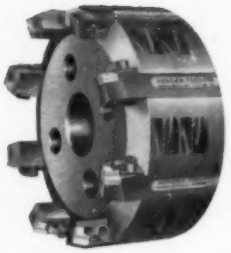
KENDEX* turnover "throw-away" principle adaptable to many special cutting jobs

Quick, accurate indexing . . . fast tool changes . . . *no* costly grinding . . . all of which add up to higher production with lower tool investment and minimum maintenance costs.

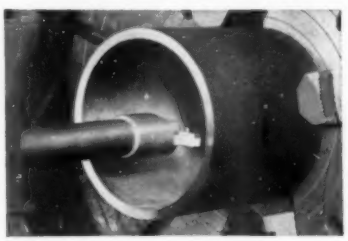
These are the Kendex advantages that have resulted in adaptation of Kendex to many *special* job applications; odd job milling, step milling, face milling, and boring, chamfering, turning, and profiling operations. A few adaptations of the Kendex design principle to varied cutting problems are illustrated.

But, no matter if it's a special or a standard machining operation, Kendex Tooling provides many distinct advantages. In addition to quick, accurate indexing, without resetting the toolholder, and the elimination of all grinding, Kennametal* "throw-away" button inserts reduce machine down time and speed up production.

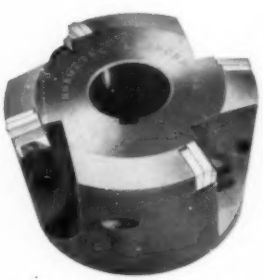
Why not let a Kennametal tool engineer help you select the right Kendex Tooling for each job . . . special or standard. By training and experience, he is qualified to analyze tooling problems and recommend right solutions. Or write KENNAMETAL INC., Latrobe, Pennsylvania.



Eight standard Kendex Tools adapted to odd job milling



Boring bar equipped with standard Kendex Tooling



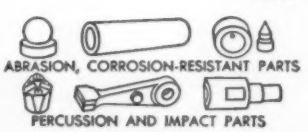
Special 4-step boring head with adaptation of standard Kendex "throw-away" inserts and clamp mechanism

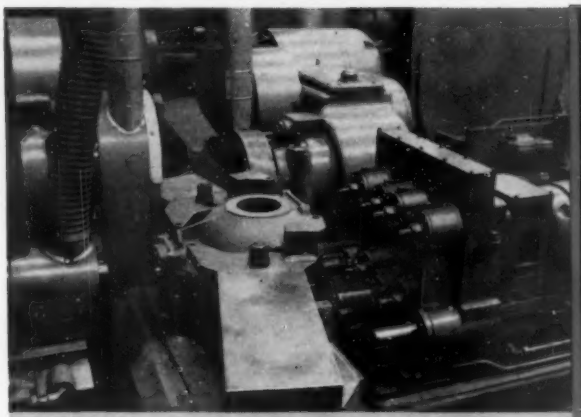
A standard Kendex Tool fitted to a special bar

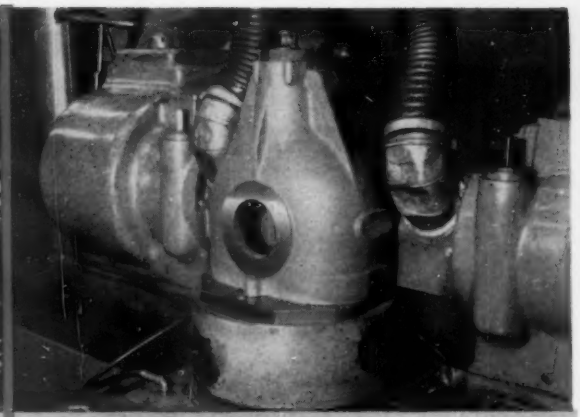
*Registered Trademark

D-5001

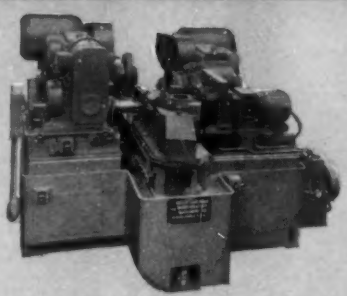
INDUSTRY AND KENNAMETAL ...Partners in Progress

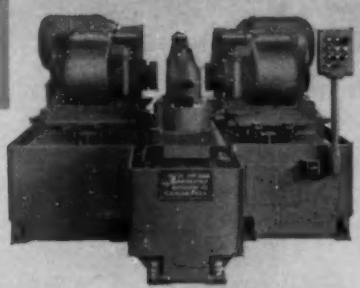






Three stations rough and finish machine: (1) mill, (2) drill, bore, (3) ream gear box castings.





Duplex milling at different levels: 4 sides milled, two sides simultaneously, with rotary rise-fall index table.

TWO MOTCH & MERRYWEATHER MACHINES CONTRIBUTE TO FULL AUTOMATION AND REDUCE MACHINING TIME 1/3!

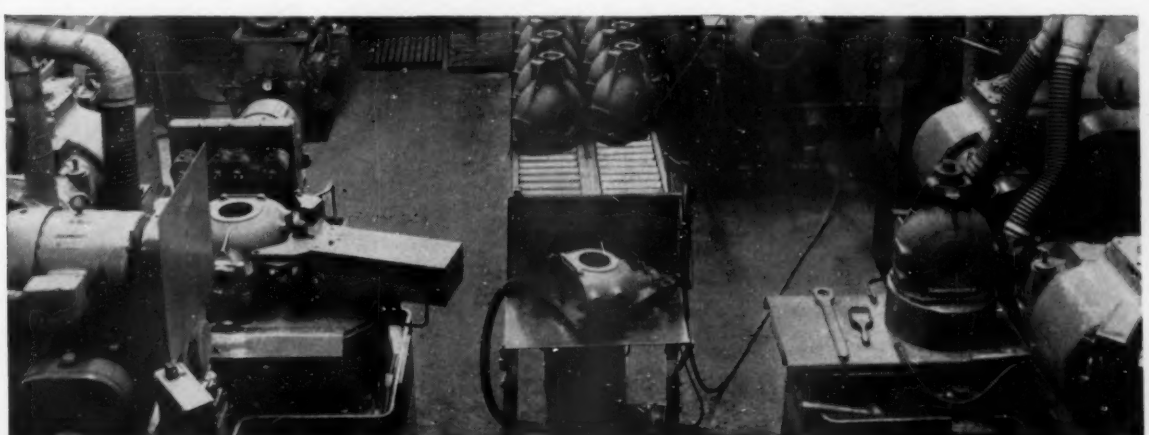
NEW HOLLAND MACHINE COMPANY Gets Cost-Reducing Boost with a Motch & Merryweather Production Solution

A "production solution" by Motch & Merryweather will invariably be the lowest cost way to get the highest production of new parts or to reduce current manufacturing costs. Efficient fixturing, using standard units, and combining operations produce results which compare favorably with the most automatic production systems. First or last, but always, get a production proposal from Motch & Merryweather.

THE MOTCH & MERRYWEATHER MACHINERY CO.

MACHINERY MANUFACTURING DIVISION

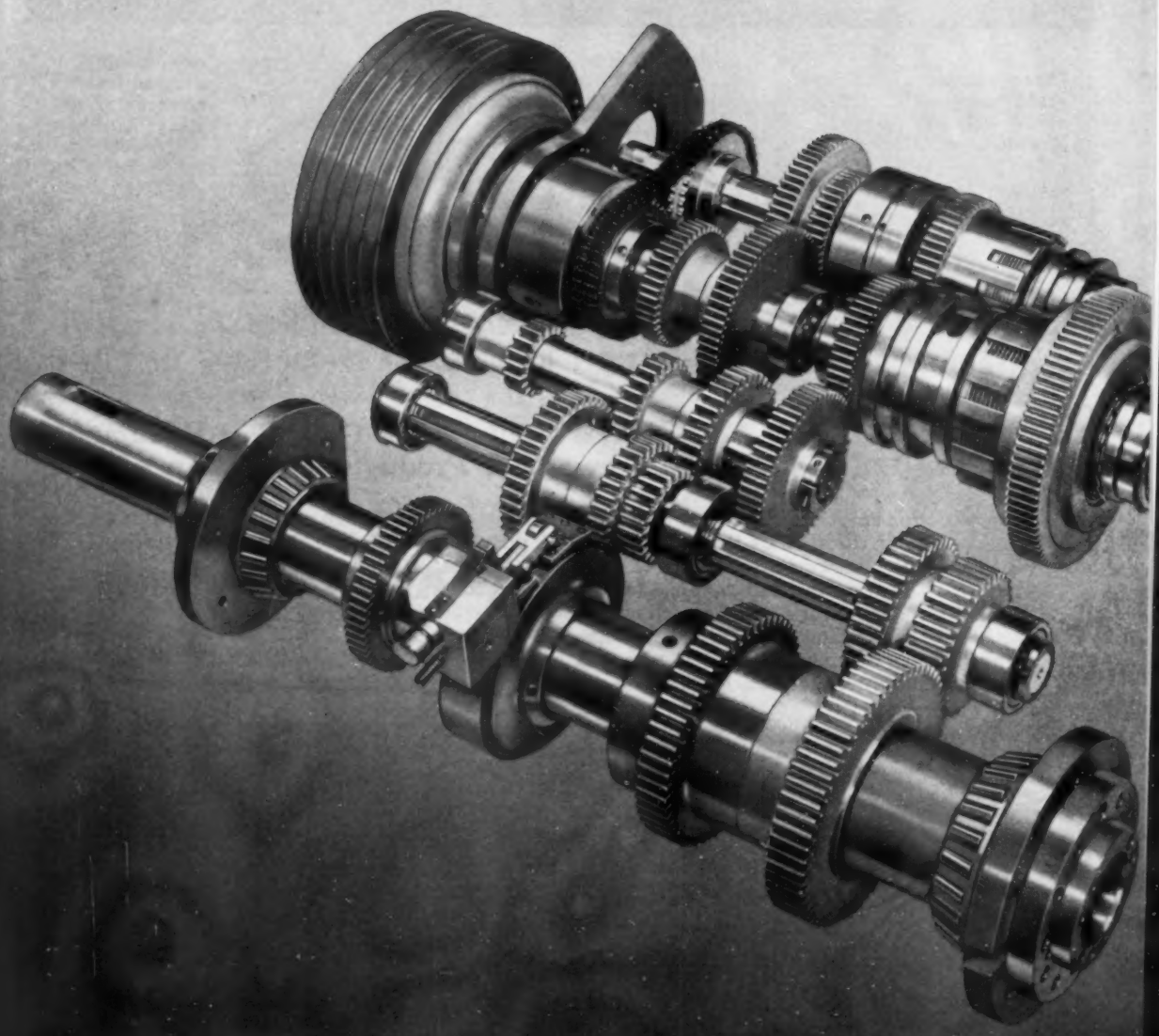
CLEVELAND 3, OHIO



Installation of machines described above, showing arrangement in production line.

The **power reserve** *and* **range of speeds**

YOU'LL NEED FOR THE



TOOLS OF TOMORROW

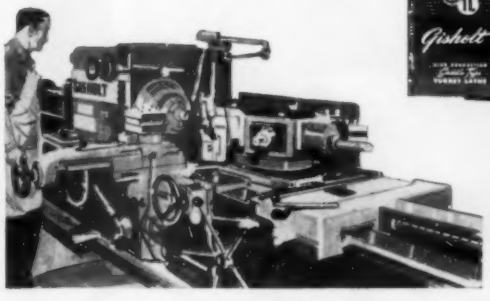
New GISHOLT MASTERLINE SADDLE TYPE TURRET LATHE

WANT MAXIMUM OUTPUT AND ACCURACY from today's carbide tools—with an ample reserve of power and speeds to meet tomorrow's tooling requirements?

That's what you'll get—*now*—from this powerful, rugged Gisholt MASTERLINE Saddle Type Turret Lathe. Prime example of this machine's advanced features is the rugged Headstock Gear Train, shown at the left. Here, you can get 24 different forward speeds—all from a *single*-speed motor. This means you get *full* power *all* the time—a critically important feature for those heavy cuts at punishing feeds.

But that's not all. To give you maximum performance from this powerful gear train, Gisholt designers have backed it with faster speed changes through the Hydraulic Speed Selector (effortless speed shifts without waiting or computing); a hydraulically operated Hi-Lo speed change in a 6:1 ratio (without stopping the spindle or shifting gears); and a new Self-Adjusting Electric Clutch and Brake (smooth, fast starting and stopping, plus more accurate inching of the spindle).

Ask your Gisholt Representative to give you the complete facts. Why not call him today?



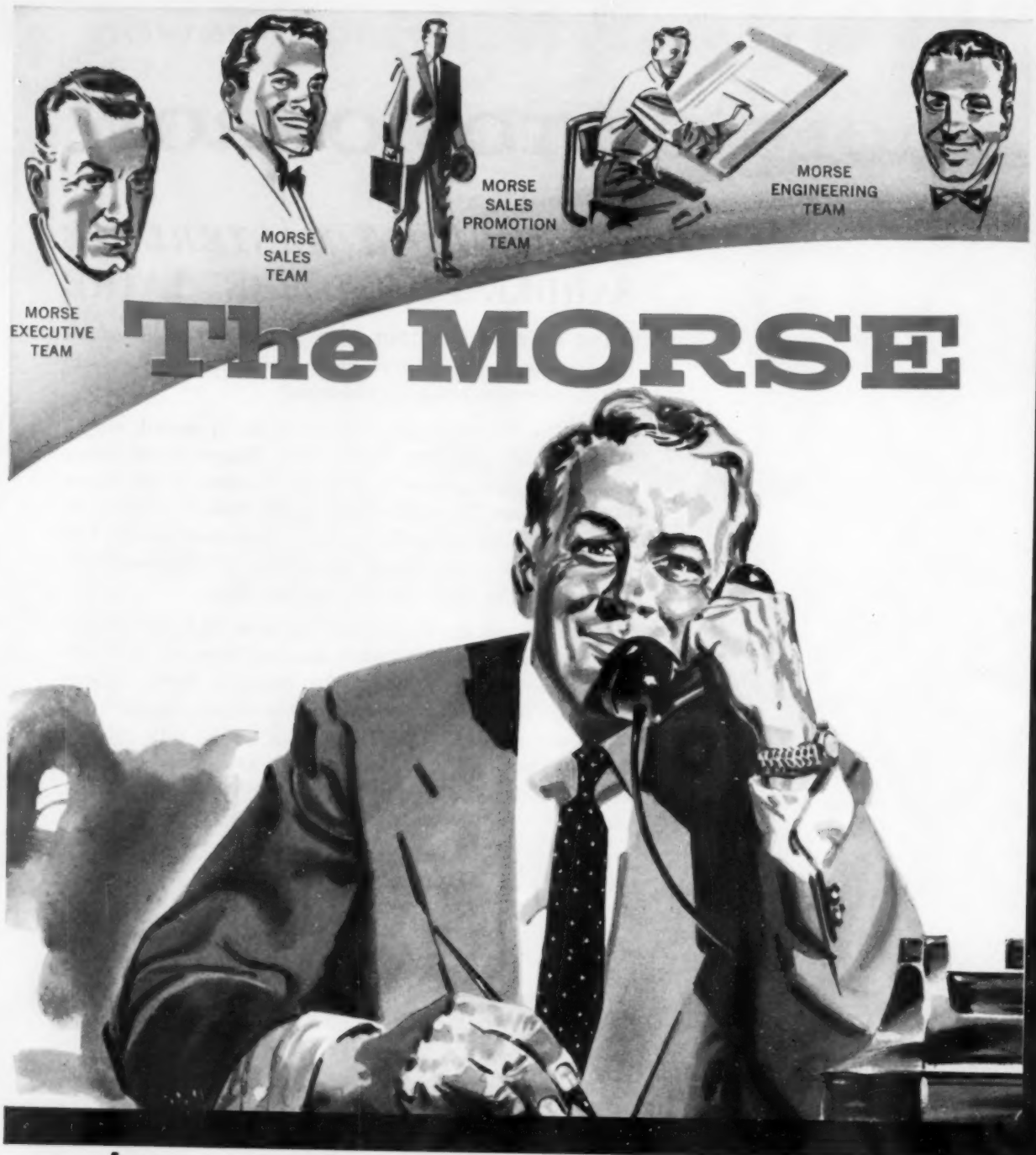
ASK FOR complete set of Gisholt MASTERLINE Saddle Type Turret Lathe Bulletins.

GISHOLT MACHINE COMPANY

MASTERLINE GISHOLT SINCE 1887

Madison 10, Wisconsin, U.S.A.

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • PACKAGING MACHINES • MOLDED FIBERGLAS PLASTICS



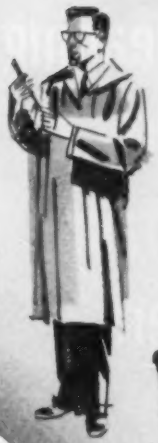
Another Reason Why—MORSE

MORSE EXPEDITING TEAM

MORSE PRODUCTION TEAM

MORSE PRODUCT DEVELOPMENT TEAM

MORSE INVENTORY CONTROL TEAM



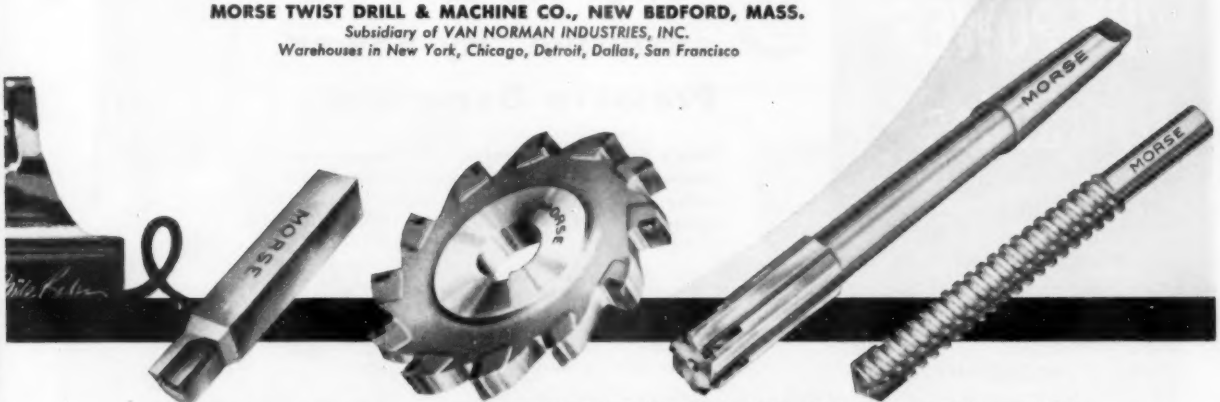
MORSE MACHINE DESIGN TEAM

MORSE TEAM OF CARBIDE TOOL SPECIALISTS

TEAM

...all Specialists
...all Backing Up
your MORSE FRANCHISED DISTRIBUTOR

MORSE TWIST DRILL & MACHINE CO., NEW BEDFORD, MASS.
Subsidiary of VAN NORMAN INDUSTRIES, INC.
Warehouses in New York, Chicago, Detroit, Dallas, San Francisco



means "THE MOST" in Cutting Tools

how leading car, truck and trailer builders solve production riveting problems with Hannifin "HY-POWER" Hydraulics

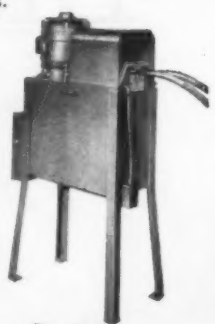
1 They select the correct size "Hy-Power" Hydraulic Cylinders

Hannifin supplies "Hy-Power" Hydraulic Cylinders in 7½ to 100-ton capacities (more in multiple) to exert the force exactly when and where you want it.

2 They mount the cylinders in Hannifin "C"-Frames

The "Hy-Power" line includes standard "C"-frames in a wide variety of sizes and types for portable or stationary use. Or, if your requirements are special, Hannifin will design and build "C"-frames to suit your needs.

3 Power source is the exclusive "Hy-Power" Pressure Generator



Here's Hannifin's patented, noiseless pressure generator. It's a compact unit that combines motor, pump, oil reservoir, control valves and high-pressure intensifier.

HANNIFIN "HY-POWER" RIVETING IS THE LONG-TIME STANDARD OF THE AUTOMOTIVE INDUSTRY

If you're looking for a better riveting method—whether you need one riveter or fifty—discuss it with your Hannifin representative. Meanwhile, get the full story by writing for Bulletin 150.

HANNIFIN

Air and Hydraulic Cylinders • Hydraulic Presses • Pneumatic Presses • "Hy-Power" Hydraulics • Air Control Valves

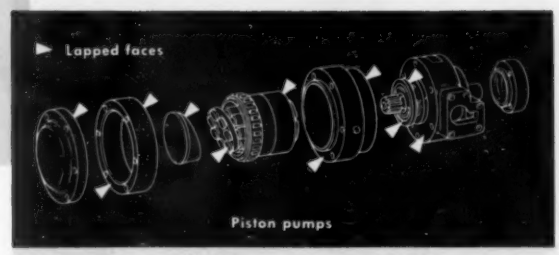
Hannifin Corporation, 519 South Wolf Road, Des Plaines, Illinois

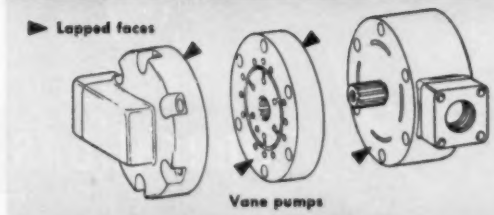
How Pump Manufacturers Use the

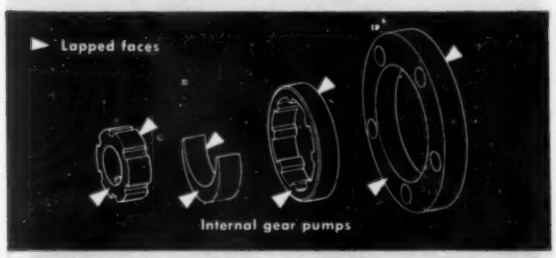
Lapmaster® To Improve Product Performance

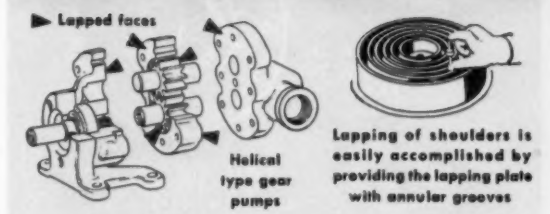
Like valve manufacturers, a large number of pump manufacturers need precision flatness and finish in order to insure efficient product performance. They're getting *both* flatness and finish plus parallelity in production quantities with Lapmasters. Photos at right illustrate a few typical parts being machined daily.

The high production accuracy of the Lapmaster (micro-inch finishes of 2 to 3 RMS—surface flatness to less than .000011" when required) is being achieved on all materials including cast iron, steel, stainless steel, magnesium, aluminum, brass, carbon, ceramics, plastics and sintered metals. It will pay you to investigate this modern precision, yet economical, method of machining.





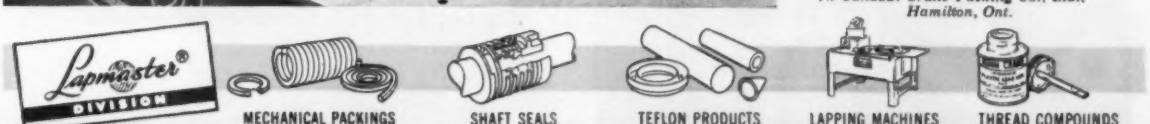



Lapped faces
Helical type gear pumps
Lapping of shoulders is easily accomplished by providing the lapping plate with annular grooves

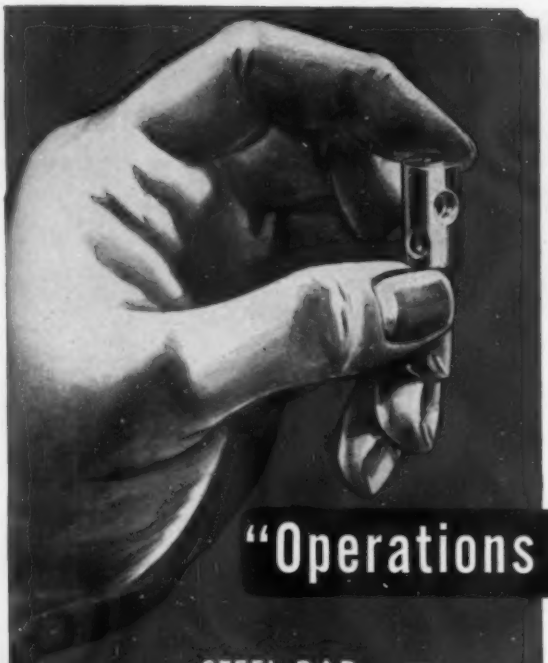
*Protected by U.S. and Foreign Patents

FREE TECHNICAL DATA
These three booklets will give you the facts on producing and measuring precision flatness and finish. Write for your copies today.

Crane Packing Company
6423 Oakton St., Morton Grove, Ill.
(Chicago Suburb)
In Canada: Crane Packing Co., Ltd., Hamilton, Ont.



CRANE PACKING COMPANY

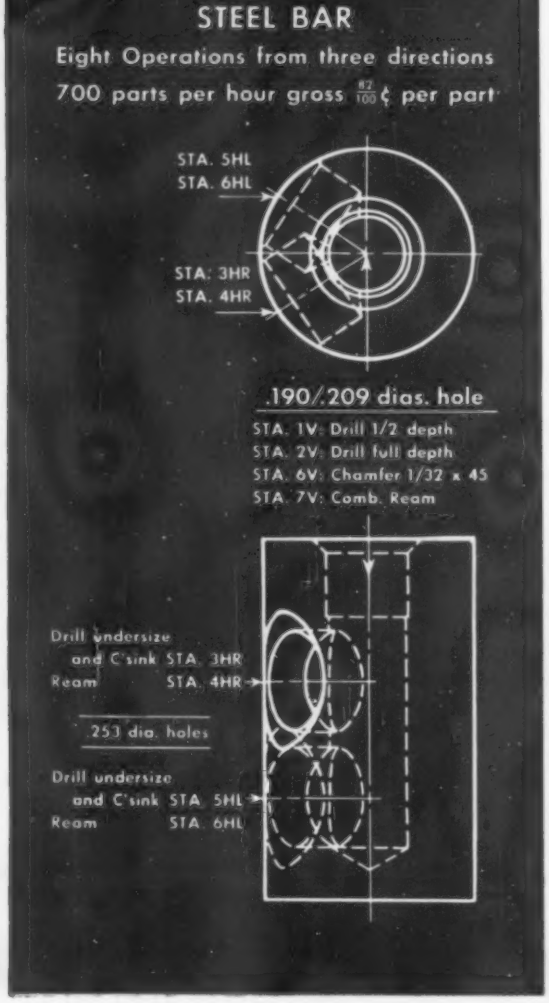


How would you jig and set up to perform nine operations on these three holes simultaneously in 5.11 seconds for 82/100¢ per part?

At first glance it looks like a cinch! . . . just use three drilling units with combination tools!

But each hole must also be reamed, and the part has no fixed locating point for a second chucking . . .

"Operations Kingsbury" maintains high

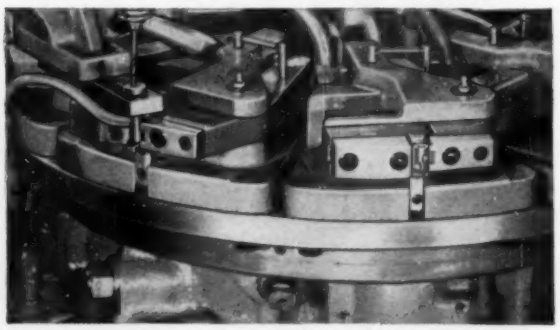

STEEL BAR
Eight Operations from three directions
700 parts per hour gross 82/100 ¢ per part
STA. 5HL
STA. 6HL
STA. 3HR
STA. 4HR
.190/.209 dias. hole
STA. 1V: Drill 1/2 depth
STA. 2V: Drill full depth
STA. 6V: Chamfer 1/32 x 45
STA. 7V: Comb. Ream
Drill undersize and C'sink STA. 3HR
Ream STA. 4HR
.253 dia. holes
Drill undersize and C'sink STA. 5HL
Ream STA. 6HL

The part is a steel cylinder ½ inch diameter and 13/16 inch long. Vertical hole is along the axis. Horizontal holes are located on two levels, 67° apart.

Manually-operated work-holding fixtures are designed to hold the part with the axis vertical. It is seated firmly against locators at the bottom, back and left-hand side, and clamped from the right. All operations are performed without removing the part from the fixture.

Six Kingsbury units are mounted on a 60-inch base. Eight work-holding fixtures are mounted on a 20½-inch table, which indexes through eight stations, one used for loading and unloading.

At Stas. 1 and 2 a vertical unit is equipped with a two-spindle auxiliary head. At Sta. 1-V, one spindle drills the .190 dia. axial hole undersize to half depth. A bushing guides the drill. At Sta. 2-V the second spindle drills the hole to full depth. This two-stage operation



Eight precision-built fixtures accurately mounted on the Kingsbury dial assure perfect interchangeability.

is necessary in order to complete this work within the required time period.

At Sta. 3-HR a horizontal unit with combination tool drills the upper (right hand) .253 dia. hole undersize to connect with the axial hole. It also forms the countersink. A similar unit at Sta. 4-HR reams this hole. Bushings guide the tools.

Identical operations are performed on the lower (left hand) hole at Stas. 5-HL and 6-HL.

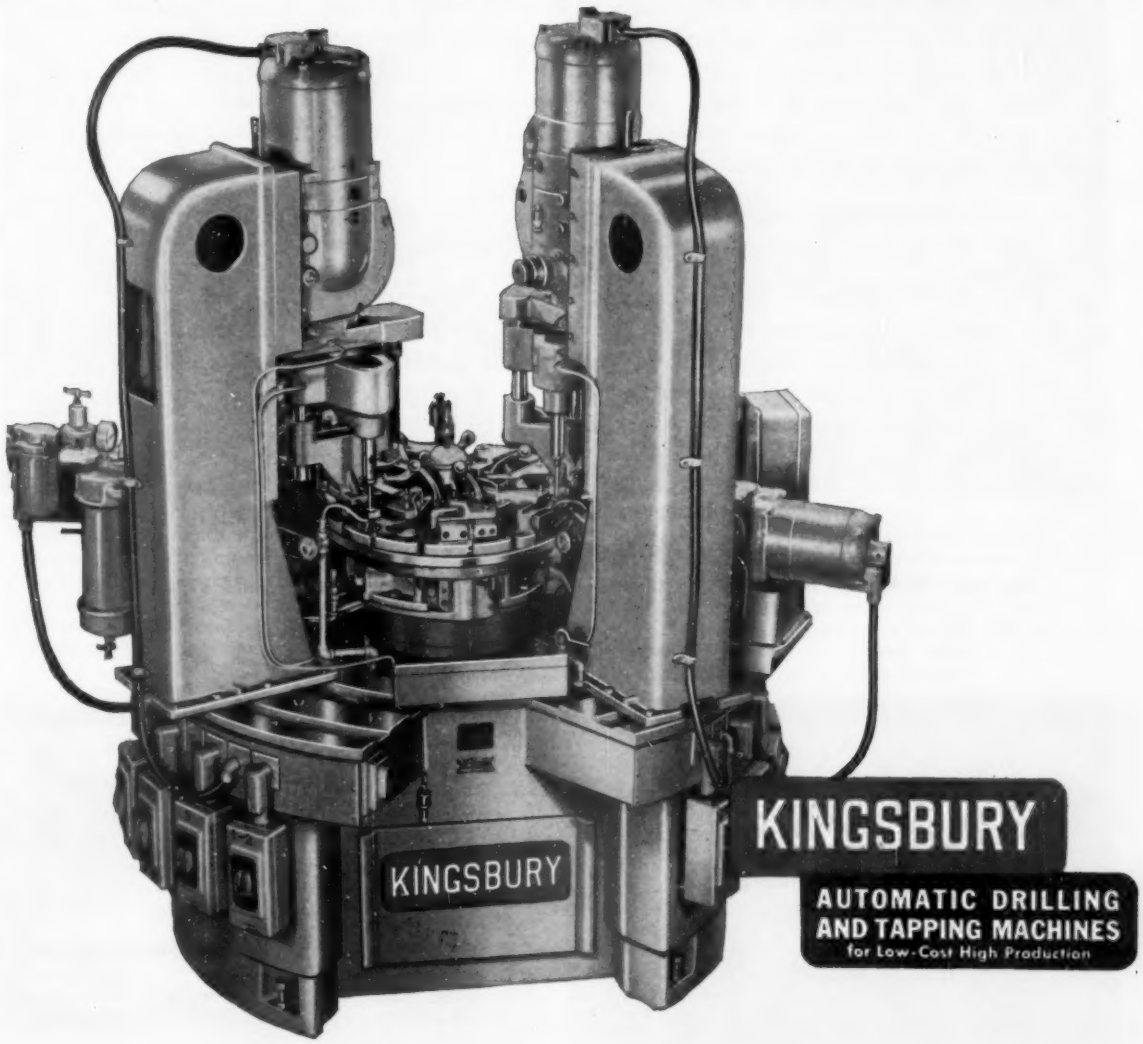
At Stas. 6 and 7, a vertical unit is equipped with a two-spindle auxiliary head. Spindle at Sta. 6-V chamfers the axial hole 1/32 x 45°. Spindle at Sta. 7-V combination step-reams the hole to .190/.209 diameters, removing the burrs from the break-through of the two horizontal holes.

* * *

Going back to our first premise: it's a cinch — *on a Kingsbury*. But what makes it a cinch? Specially designed work-holding fixtures that are uniformly accurate. Kingsbury heads, bases, indexing tables, electrical controls — all working together in perfect *automation* — *plus* the experience and skill of our engineers who are always looking for better ways to make better Kingsburys. Let us show you!

Kingsbury Machine Tool Corp.
118 Laurel St., Keene, N. H.

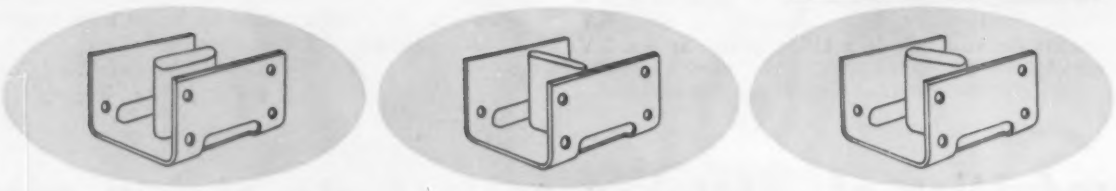
production of interchangeable parts at low cost



here's a good example of

MULTIPLE BROACHING

. . . . on the LAPOINTE



DESIGNED TO BROACH 6 PARTS, each part different but all having 5 broached surfaces, this LAPOINTE Continuous Broaching Machine certainly makes the most of each production minute! These magnet cores must be broached to very close tolerances. Being thin, they are difficult to hold without springing and distorting — yet all surfaces must be parallel and square. That troublesome problem was solved by Lapointe-built fixtures, with automatic clamping and ejecting features.

Production, at 30 feet-per-minute broaching speed, is as follows: with 10 fixtures, 720 parts/hour; with 15 fixtures, 1080 parts/hour; with 19 fixtures, 1368 parts/hour.

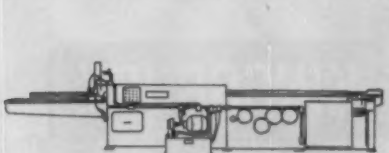
The machine is versatile. Fixtures are complete with adapter assemblies, arranged to interchangeably accept adapter assemblies for other parts. The broaches themselves are changed with a minimum of time and effort. This plant is benefiting from the conversion to LAPOINTE-BROACHING. Perhaps you can, too. Why not have a discussion with a Lapointe Field Engineer?

THE LAPOINTE MACHINE TOOL COMPANY

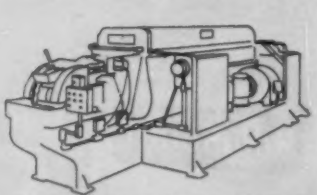
HUDSON, MASSACHUSETTS • U.S.A. *In England: Watford, Hertfordshire*

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

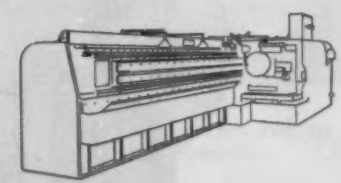
Here's a line of ELECTRO-MOTIVE DRIVE BROACHING MACHINES . . . . . available only at LAPOINTE



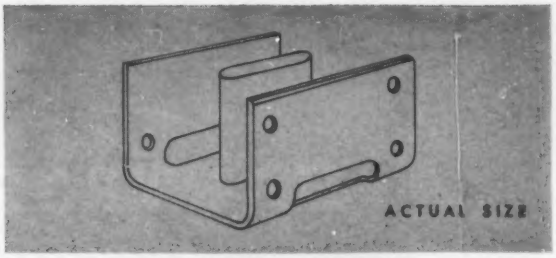
60" STROKE HORIZONTAL, ELECTRIC



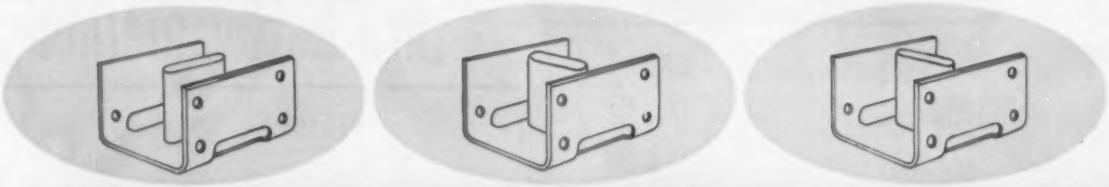
CH CONTINUOUS BROACHING, ELECTRIC

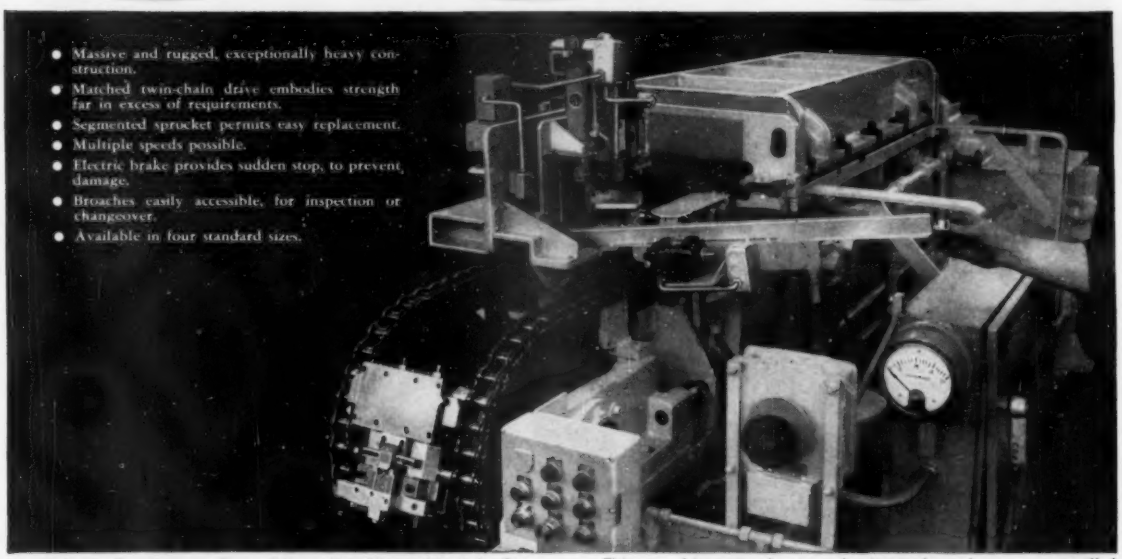


SRHE SINGLE RAM HORIZONTAL, ELECTRIC



CONTINUOUS BROACHING MACHINE

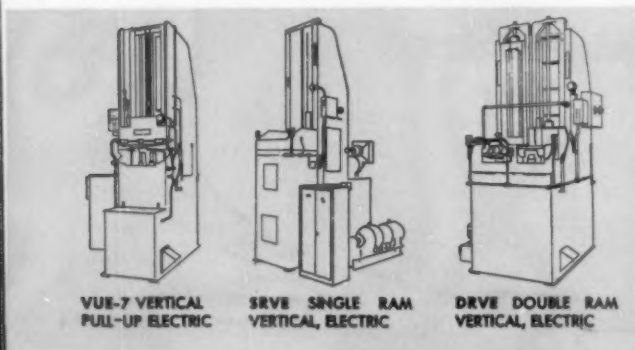



• Massive and rugged, exceptionally heavy construction.
• Matched twin-chain drive embodies strength far in excess of requirements.
• Segmented sprocket permits easy replacement.
• Multiple speeds possible.
• Electric brake provides sudden stop, to prevent damage.
• Broaches easily accessible, for inspection or changeover.
• Available in four standard sizes.

Lapointe Continuous Broaching Machine: Model CH, 10 hp., 66-inch stroke; variable speed drive, 5 to 40 feet-per-minute. Shown here with automatic loader, to broach magnet cores. Hand feed loading chute mechanically places the part in the broaching fixture, and the part will "bottom" positively in the fixture with exact yoke locating on leg edges.

This machine simultaneously broaches the two parallel top edges, the centre oval projection (.003/.005" lower than the outer edges), the 45° chamfer on one leg, and the corner break on the other leg.

LAPOINTE takes all the responsibility for your *continuous broaching program.* We design and build the broaching machines, design and build the broaching fixtures, design and make the broaches!



VUE-7 VERTICAL PULL-UP ELECTRIC

SRVE SINGLE RAM VERTICAL, ELECTRIC

DRVE DOUBLE RAM VERTICAL, ELECTRIC

LAPOINTE

known to be the best in

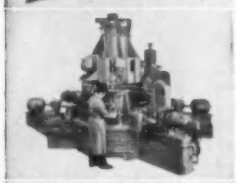
BROACHING

HARTFORD Special
OFFERS
better products
at lower cost
thru better methods
Eight Station Horizontal Indexing
Drilling, Reaming & Milling Machine

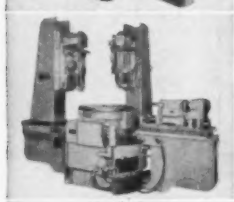
ONE SOURCE FOR BOTH

Automatic Production Machines

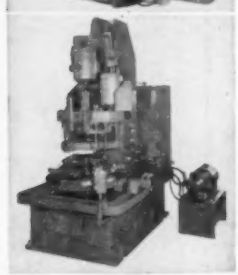
Double End Trunnion Type Machine



Center Column Indexing Type Machine

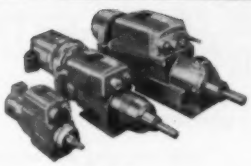


Universal Drilling Machine for jet aircraft components



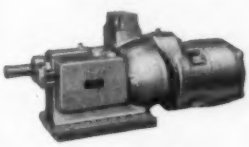
Vertical Single Unit Multiple Spindle Indexing Machine

Standard Machine Components

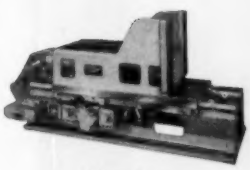


Quill Type Air Hydraulic Drill Units

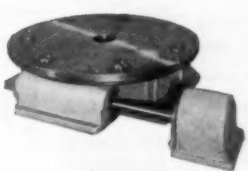
Quill Type Cam Units



Quill Type Lead Screw Tapping Units



Way Type Hydraulic Feed Units



Automatic Index Tables Horizontal and Vertical

Machine Bases

Designing and building automatic production machines like those illustrated are a "Hartford" specialty. Years of experience have proven that dependable high production and economy can best be brought to the user by means of standard machine components.

Now Hartford Special offers these production tested components to users for machines of their own construction.

Consult Hartford engineers for either—completely tooled machines or components.

HARTFORD Special

MACHINE TOOL DIVISION
THE HARTFORD SPECIAL MACHINERY CO.
28010 HOMESTEAD AVE., HARTFORD 12, CONN.

Hartford also makes automatic Thread Rolling Machines, Special Machinery and the world famous Super-Spacer.

ANNOUNCING THE

TO HELP YOU COMPARE a U. S. PowerGrip XX Heavy Duty "Timing" Belt drive with the four other common forms of power transmission of equal capacity, a power transmission engineer offers his recommendations based on published application and load ratings, for the following:

A 300-HP drive (at 1160 rpm.) including application factors. 3.00: 1 speed reduction. Approximately 50" center distance.

Here, complying with minimum pulley sizes and other practices commonly observed, are his recommendations (with approximate comparative cross sections of space occupied by each drive):

"TIMING" BELT DRIVE

Belt: XXH "Timing" Belt 10" wide by 160" P. L.

Motor Pulley: 9.549" P. D. (24-groove) 1¼"-pitch

Driven pulley: 28.648" P. D. (72-groove) 1¼"-pitch

Belt speed: 2900 feet per minute

V-BELT DRIVE

Belts: 10 Super Service "D"-Section V-Belts (DP-225)

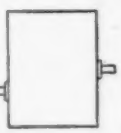
Motor pulley: 18.0" P. D. x 10. D-groove, 14¾" wide

Driven pulley: 54.0" P. D. x 10-groove, 14¾" wide

Belt speed: 5380 feet per minute

GEAR DRIVE

Herringbone gear speed reducer with 3:1 ratio. (A typical reducer of required capacity weighs 1440 lb., measures 33" long, 26⅝" high and 19" wide.)



ROLLER CHAIN DRIVE

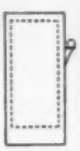
Chain: #80-8 (8 strands) 1"-pitch x 152 pitches

Motor sprocket: 7.979" P. D. (25 teeth)

Driven sprocket: 23.880". P. D. (75 teeth)

Chain speed: 2380 feet per minute

(Requires Type #3 lubrication with oil-tight case for sump pump)



FLAT BELT DRIVE

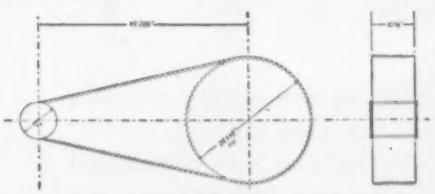
Belt: 21" wide x 8-ply x 18' 4" long

Motor pulley: 18" O. D. x 23" wide

Driven pulley: 54" O. D. x 23" wide

Belt speed: 5380 feet per minute

Schematic of "Timing" Belt drive used for comparison above



Rubber cut away to show steel cables

THE "TIMING"® BELT DRIVE FOR HEAVY-DUTY MACHINERY

THIS LIFE-SIZE illustration only begins to suggest the brute strength built into this double extra-heavy-duty tooth-grip belt with steel-cable tension member *designed for drives up to 1000 hp.* Appearance doesn't tell the whole story, because, rating for rating, U. S. PowerGrip "Timing" Belt drives are lighter in weight and occupy less space* than any other form of mechanical power transmission.

Approximately 2½ times larger—and 2½ times stronger—than the standard "Heavy Duty" series, the new XX Heavy Duty drives bring to high-torque power transmission a never-before-obtainable combination of features:

- **Highest-efficiency positive transmission of power.**
- **Complete elimination of drive lubrication (including the problems and accessories involved).**
- **Precise angular synchronization ("Timing") between two or more shafts.**
- **Quiet operation.**
- **Practical elimination of power loss due to slippage, friction and high initial tension.**
- **Compactness and high strength-to-weight ratio.**
- **Belt speeds as high as 7500 fpm.**
- **Low initial cost; no maintenance; long life.**

A complete line of U. S. PowerGrip "Timing" Belts—plus expert engineering assistance—is available at any of the 28 "U.S." District Sales Offices, at selected "U.S." power transmission distributors, or by writing U. S. Rubber, Mechanical Goods Div., Rockefeller Center, New York 20, N. Y. In Canada, Dominion Rubber Co., Ltd.

*Including accessories required by some other drives.

US RUBBER

Mechanical Goods Division

United States Rubber

still the winner

. . . and in high speed steels, nothing beats REX

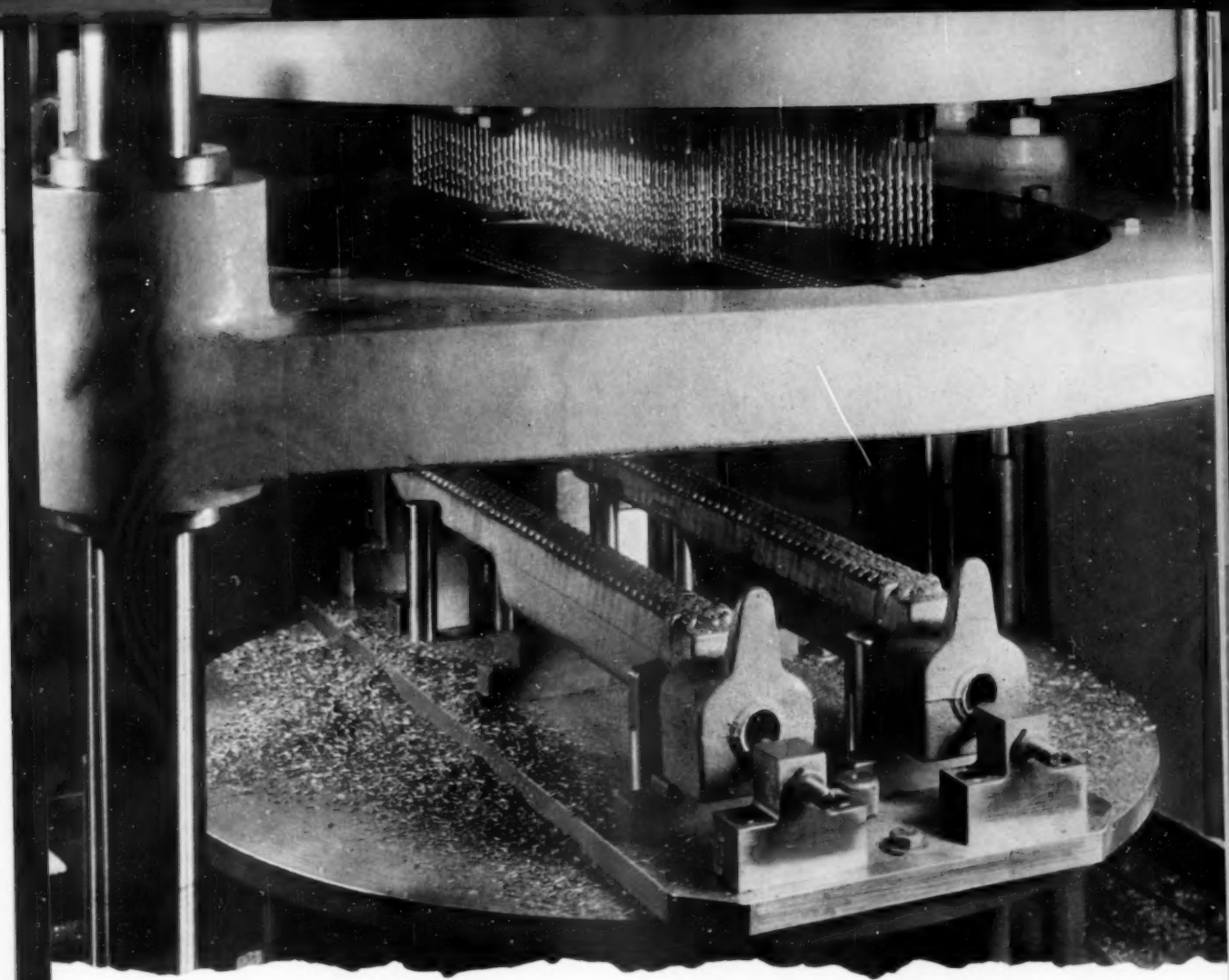
The winner and still champion after fifty years is Crucible's REX high speed steel. *And now it's better than ever!* Recent improvements in manufacturing processes have given even higher quality and greater uniformity to every one of its properties.

Why not shop test the new REX yourself? Test it for size, structure, response to heat treatment, fine tool performance. Give it any test you wish. You'll see why it is today, as it has always been — *the standard by which all other high speed steels are compared.*

Ask for REX by name at your local Crucible warehouse. Or order it directly for prompt mill delivery. And for information on REX, and the other Crucible special purpose steels, send for the *Crucible Publication Catalog. Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America



Uniform quality and high performance of CLE-FORGE High Speed Drills can help you reach production quotas

COSTLY "DOWN TIME" REDUCED!

● You can keep your drilling operations *on schedule* with CLE-FORGE High Speed Drills. These fine quality tools give superior performance on *every set-up* . . . and you can rely on their *uniformity* day after day, month after month, year after year.

◈ Why not ask a Cleveland Service Representative for suggestions on reducing "down time" and increasing production in *your* shop? Contact our nearest stockroom, or . . .

TELEPHONE YOUR INDUSTRIAL SUPPLY DISTRIBUTOR

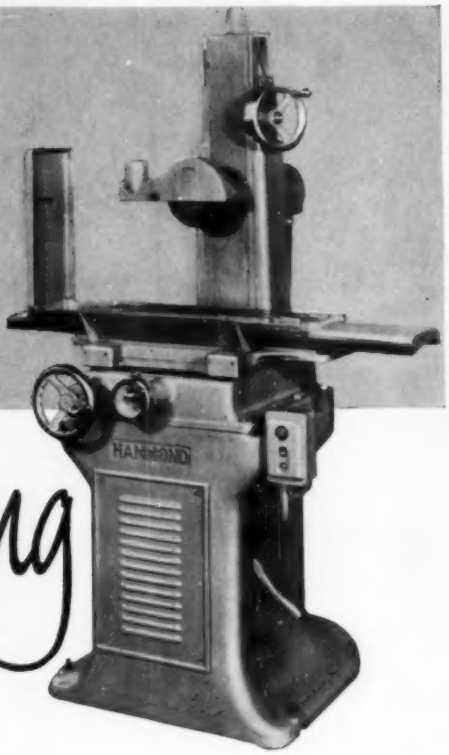
THE CLEVELAND TWIST DRILL CO.

1242 East 49th Street • Cleveland 14, Ohio

Stockrooms: New York 7 • Detroit 2 • Chicago 6 • Dallas 2 • San Francisco 5 • Los Angeles 58

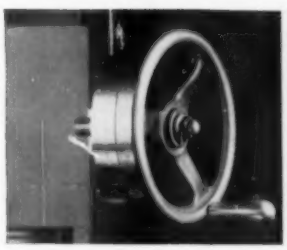
E. P. Barrus, Ltd., London W. 3, England

FOOTBURT

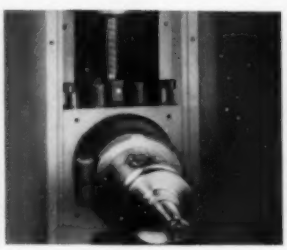


Accurate grinding for small parts

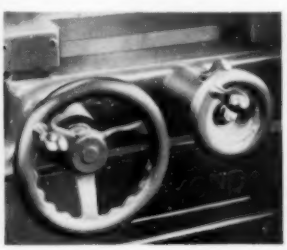
■ The Hammond No. 2, 6" x 18", Surface Grinder is a precision tool room machine for use on the most accurate gauge and tool work. The standard spindle is direct motor driven and is mounted on precision preloaded ball bearing. Total vertical adjustment is 10¾". In and out movement of table is 6½" with a longitudinal travel of 18".



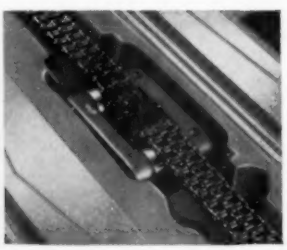
ACCURATE SPINDLE ADJUSTMENT—Standard vertical adjustment of spindle through handwheel is .0005". With Vernier attachment, spindle can be raised accurately to .00005".



SOLIDLY SUPPORTED SPINDLE CARRIER—Spindle carrier is moved vertically on double dovetail ways with adjustable tapered gibs.



CONVENIENT HAND CONTROL—Handy wheels for cross travel, accurately gauged to thousandths, and quick acting longitudinal travel.



SMOOTH ROLLER CHAIN TABLE DRIVE—Remarkably smooth finish on work without chatter marks frequently found when table is moved by conventional means through rack and pinion.

Write or wire for further information.

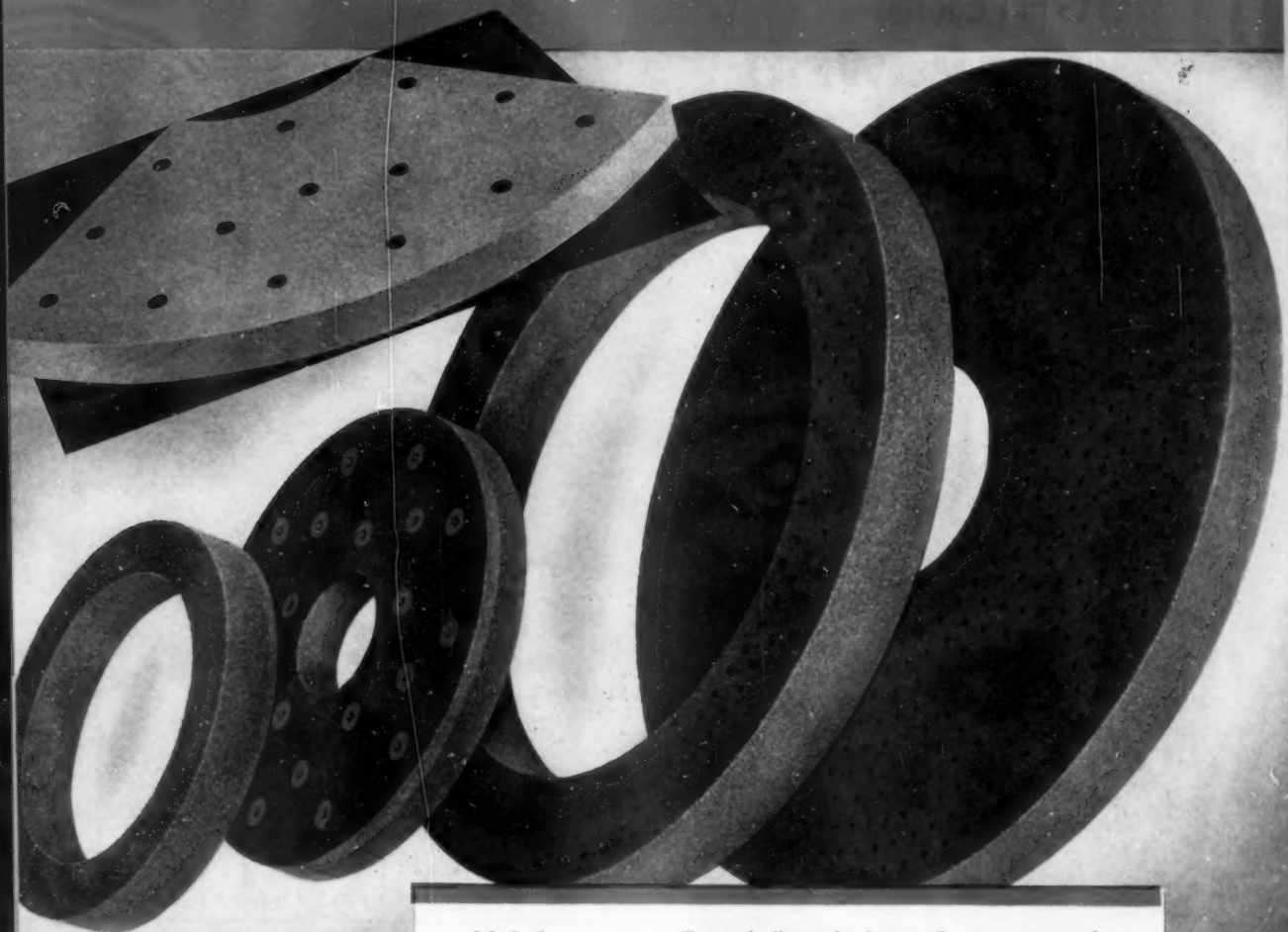
THE FOOTE-BURT COMPANY • Cleveland 8, Ohio • Detroit Office: General Motors Building

FOOTBURT

SURFACE GRINDING

SIMONDS
ABRASIVE CO.

Nut or bolt inserted
ABRASIVE DISCS
for faster production



Made by an outstanding grinding wheel manufacturer expressly for use on Besly, Gardner, Hanchett and similar grinders . . . furnished in grain and grade specifications specially engineered to give better, faster production . . . available in all sizes to fit all grinders, back plates and bolt hole layouts . . . supplied plain or perforated, solid or sectional, for use singly or in pairs. Only usable abrasive charged for. Send for Bulletin ESA 54.

SIMONDS ABRASIVE COMPANY • PHILADELPHIA 37, PA.

Branch Warehouses: Boston, Detroit, Chicago, Portland, San Francisco. Distributors in Principal Cities
Division of Simonds Saw and Steel Co., Fitchburg, Mass.

CALL **YOUR SIMONDS DISTRIBUTOR**

LOCAL STOCK
FAST SERVICE

NEW! ROTOR AIR GRINDERS

LIGHTER!

MORE POWER!

Rotor "D-6" ... the new, lightweight (9¼ lbs.) tool for heavy-duty work

Rotor "D-8" ... all the power you can use and weighs only 12¼ lbs.

SPECIFICATIONS				
	RPM	WEIGHT*	LENGTH†	WHEEL SIZE
D-6	6000 4500 4100	9¼ lbs.	22¼″	6″ elastic 8″ elastic 8″ elastic
D-8	6000 4500 4100	12¼ lbs.	21¾″	6″ elastic 8″ elastic 8″ elastic

*For straight handle. For grip handle add ¾ lbs.
†Deduct 1½″ for grip handle.

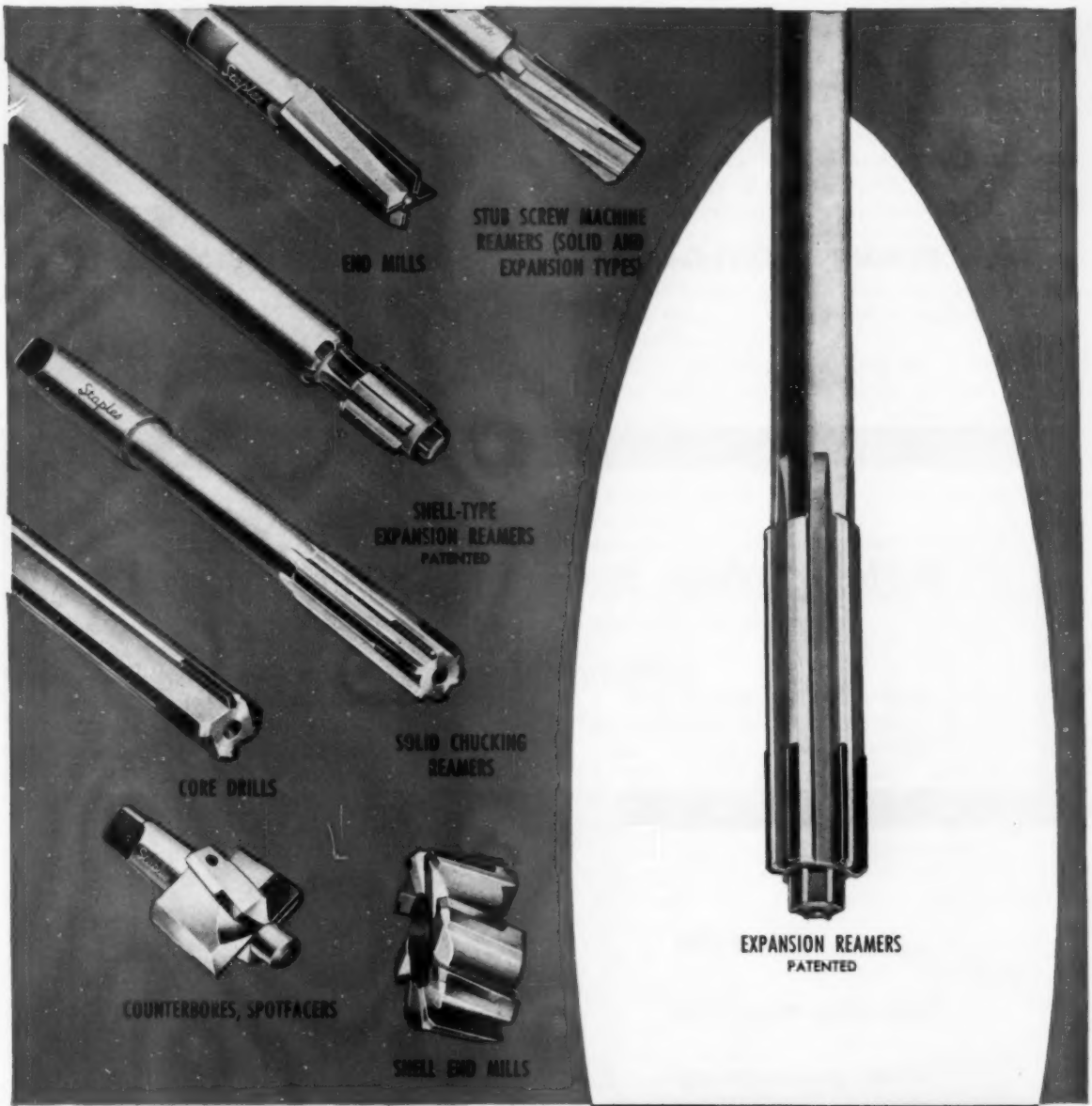
ASK FOR BULLETINS NO. 45 and NO. 46

AIR HIGH CYCLE

THE ROTOR TOOL CO.

CLEVELAND, OHIO

UNBIASED ANALYSIS OF PORTABLE TOOL PROBLEMS



Lower Your Costs With Staples Carbide Tools

Precision and quality built into these tools results in overall economies as proven by production records.

THE Staples TOOL COMPANY
CINCINNATI 25, OHIO

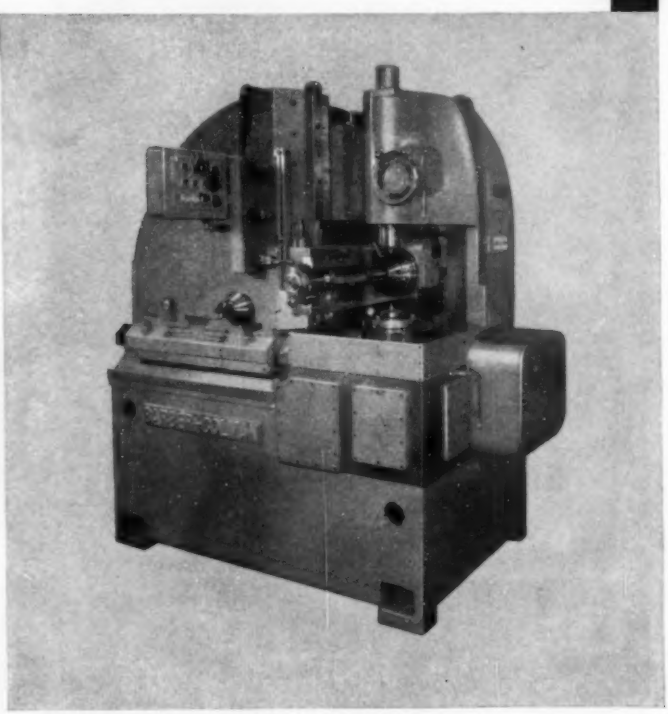
Staples
ROTATING CUTTING TOOLS CARBIDE-TIPPED

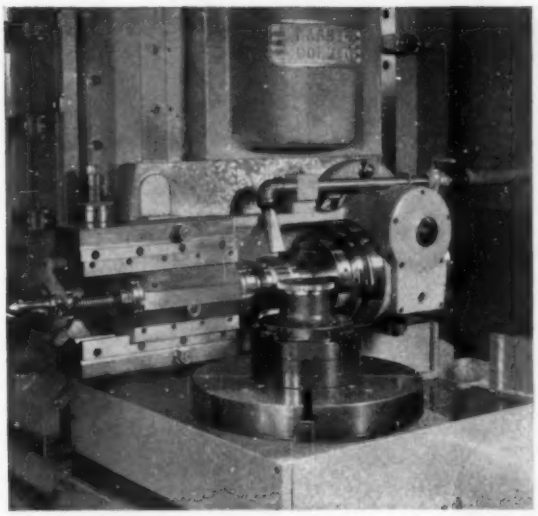
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-39

a new concept of gear accuracy!

Barber • Colman Builds World's Most Accurate Hobbing Machine

First hobbing machine ever guaranteed to cut gears within 10 seconds angular error





Barber-Colman has designed and built, in collaboration with Sperry Gyroscope engineers, a new type of hobbing machine which hobs without any further finishing operation, gears for the most accurate radar, navigational and computing equipment. This machine is known as the "Ultracision" Hobbing Machine and is so accurate that gears cut by it will transmit motion within 10 seconds of true angular rotation. This is equivalent to .0001" on 4" diameter, which is the only size that has been thoroughly investigated at the present time. This means that the combination of lead, profile and spacing errors measured over non-adjacent teeth cannot exceed 10 seconds of true angular displacement at any diameter along the involute.

In order to arrive at this degree of precision, it has been necessary to provide new methods of positively checking such accuracy. Sperry engineers utilize theodolites and auto-collimators in conjunction with pneumatic, electronic and mechanical gaging equipment which assures accurate measurement within millionths of an inch.

the machine

To produce gears of this accuracy, many new and unusual features have been incorporated in the hobbing machine. The greatest care in manufacture and assembly has been used for all parts. All vital surfaces on the machine are scraped within .0001" per foot, and even the covers are scraped to fit the scraped portions of the bed casting to prevent entry of foreign matter.

Since the machine is designed to cut only spur gears, the feed drive is independent of the main drive. Capacity of the machine is 10" diameter blanks, 6" maximum length of hob carriage travel, and maximum rated pitch capacity of 32 DP. Drives to the work and hob spindles have been made as short as possible to minimize any twisting and vibration. An extremely accurate index worm and gear are mounted in ultra-precision taper roller bearings. Except for the index change gears, the gear train between the main drive shaft and the index worm contains only a worm and worm gear, and a pair of 90° helical gears.

The basic machine weighs 11,000 lbs., (with controls 13,800 lbs.) to provide the rigidity necessary for this exceptional accuracy. Another feature for increased rigidity and accuracy is the elimination of a hob slide. The hob is mounted directly on an expanding arbor, and shifted on this arbor, rather than by means of a hob slide.

Adjustments are provided for trueing the hob spindle within a few millionths of an inch. Both hob spindle and outboard support are mounted in ultra-precision taper roller bearings.

the hobs

To attain extreme profile accuracy on the gear teeth, Barber-Colman also has developed a new class of hob called "Ultracision", and made to limits of .00008" lead variation in one axial pitch, and .00015" in 3 axial pitches. These limits are just half of those for Class AA hobs. These hobs are ground and have larger than standard diameters to permit a greater number of hob teeth for very fine finish on the gear tooth profiles. Wide hubs and a 2" diameter straight bore provide maximum rigidity for the hob.

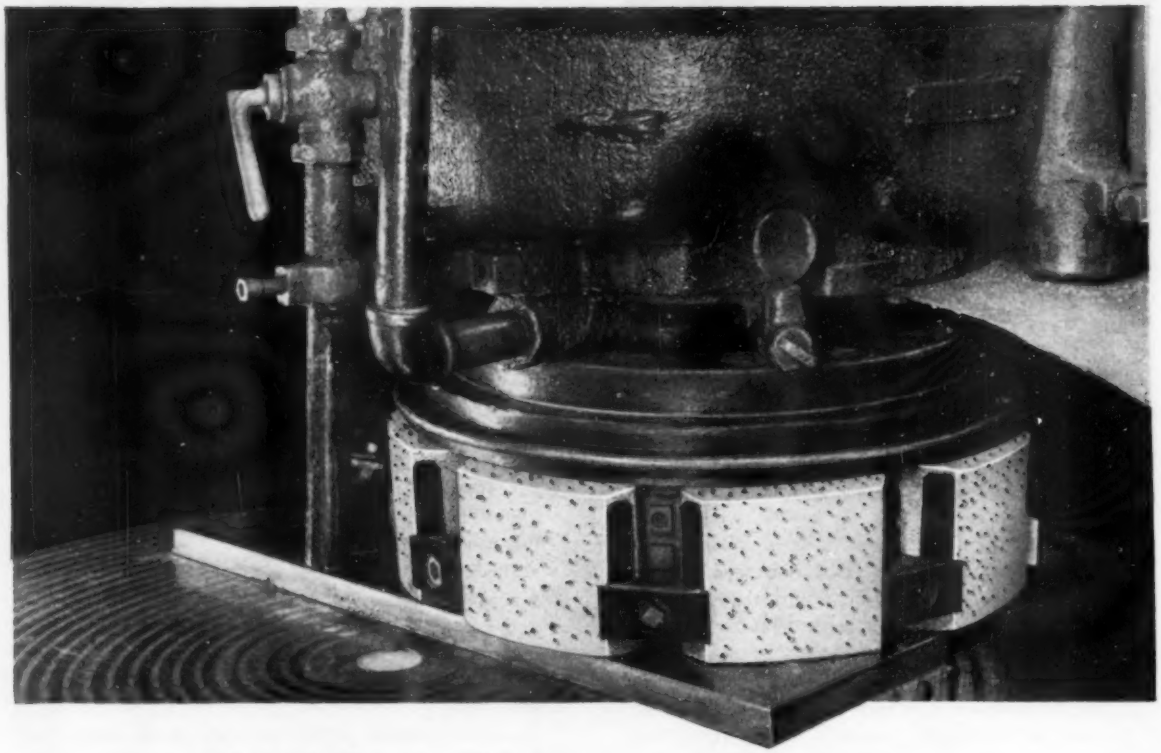
The development of this new concept in gear accuracy — the finest limits of gear accuracy ever obtained on a production basis — will eventually reflect in a higher standard of quality for gears produced on standard production hobbing machines. You are invited to submit your gear specifications and problems for analysis and recommendations by our engineers. Detailed information on the new "Ultracision" Hobbing Machine is available on request.

BARBER-COLMAN COMPANY

6310 ROCK STREET • ROCKFORD, ILLINOIS

Hobs • Cutters • Reamers • Hobbing Machines • Hob Sharpening Machines

BARBER COLMAN



on-the-job performance tests prove
IT PAYS to specify MACKLIN MM segments

A complete line of Macklin Segments provide fast cutting action without burring or checking. Fit any standard chuck.

Macklin MM Segments give better cutting action on hard-to-grind steels and carbides.

Here's Proof . . .

Macklin MM Segments increased production per segment wheel 127% in a large machinery manufacturing plant which surface grinds steel and cast iron machinery parts. Look at these figures . . .

	Macklin	*Competitive Wheel B*
Number of pieces ground per segment wheel	392	173
Segment life	13 days	6½ days
Dressings required	112 (in 13 days)	65 (in 6½ days)

Here are other typical MM Segment Performance test summaries:

Product	*Performance Record*
Cast iron table tops	Macklin MM Segments, 1000 pcs. Comp. Wheel B, 400 pcs.
Miscellaneous metal parts	Macklin MM life 2½ times greater than Brand C.
SAE 1335 heat-treated steel	Macklin MM removed as much metal in *15 hours* as Brand B removed in 35 hours.

Here's why you get these results . . .

It's the unique MM construction consisting of a fine abrasive in pellet form which is engineered into MM Segments. This construction provides a constant flow of fine abrasive particles between the wheel and the work. The result? More metal removed per segment . . . fewer dressings required . . . and finer surface finishes.

But, don't take our word for it. Call your nearest Macklin distributor and arrange for a test on your own work. You'll be glad you did.

MACKLIN company

Dept. 32 JACKSON, MICHIGAN

How optical gaging helps get Giannini air-borne instrument production off the ground faster.

In the fight for flight that's higher, farther, faster—plane and missile makers want everything smaller, lighter, tighter. Tighter means tolerances today of 0.0002″ to 0.0003″ compared to 0.003″ to 0.004″ a few years ago. That's why more and more manufacturers like aircraft and missile instrument and control maker G. M. Giannini & Co., Inc., Pasadena, Calif., are using Kodak Contour Projectors.

A pulley in one Giannini instrument is less than pencil eraser size, has groove dimension tolerance falling between 0.010″ and 0.011″, four separate angles to check out within 0.30°, a shaft diameter of plus or minus 0.0001″ or 0.0002″. Perpendicularity must be within 0.0003″. Like many aircraft parts, it's made of aluminum alloy.

Before Giannini put a Kodak Contour Projector to work on receiving inspection, getting prototypes of instruments filled with parts like this—and even tighter—used to be a mammoth problem. An undetected off-tolerance part in the master could hold up production or even throw production models out of kilter.

At Giannini, inspectors check incoming parts quickly and accurately with optical gaging, make sure they're right for the prototype. They optically check angles, shoulders, radii, positions, and all critical surfaces on a single projector. Now there's less chance than ever that production parts will be off tolerance once the master has been approved.

If inspecting small parts to tiny tolerances is a large problem with you, you should investigate optical gaging with a Kodak Contour Projector. A Kodak Contour Projector can work production and quality control miracles where control of measurements makes a better product.

Write for your copy of "Projection Gaging with Kodak Contour Projectors." Even better, ask for the name of your nearest representative, so he can personally explain projection gaging's scope and capabilities.

Inspectors quickly learn optical gaging, because it's simply a matter of looking and comparing. Perhaps you can greatly improve Toolroom, Receiving, Production, and Final inspection with a single unit. There are six models to choose from.

EASTMAN KODAK COMPANY, Rochester 4, N. Y.

the KODAK CONTOUR PROJECTOR

Kodak
TRADEMARK

Made with MAGNESIUM

DOW

A FEW POUNDS make a big difference when jigs have to be moved manually several times an hour.

MAGNESIUM FOR LOW-COST TOOLING

Lightweight magnesium tooling plate costs less to buy, less to fabricate and less to use

• **COSTS LESS TO BUY**—Magnesium tooling plate costs less than commonly used lightweight tooling materials.

• **COSTS LESS TO FABRICATE**—Magnesium jigs and fixtures are easy and economical to build, too. The reason is that magesium tooling plate is easy to machine, easy to weld.

• **COSTS LESS TO USE**—Magnesium weighs one fourth as much as steel and only two thirds the weight of aluminum. By making your jigs and fixtures with lightweight magnesium you'll increase worker efficiency and reduce lost-time injuries.

For more information about magnesium tooling plate contact your nearest supplier of Dow magnesium, or write THE DOW CHEMICAL COMPANY, Midland, Michigan, Dept. MA 397L.

Available from stock at: **Copper and Brass Sales, Inc., Detroit, Mich. • Fullerton Steel and Wire Company, Chicago, Ill. • Hubbell Metals Inc., St. Louis, Mo. • A. R. Purdy Co., Inc., Lyndhurst, N. J. Reliance Magnesium Company, Los Angeles, Calif. • Vinson Steel and Aluminum Co., Dallas, Texas.**

you can depend on DOW MAGNESIUM

DOW

The Sciaky technique of resistance welding used by the York Corporation, York, Pennsylvania.

Complex air conditioner chassis assembly costs cut 34.5%... Multi-part wrapper assembly costs cut 60.9%

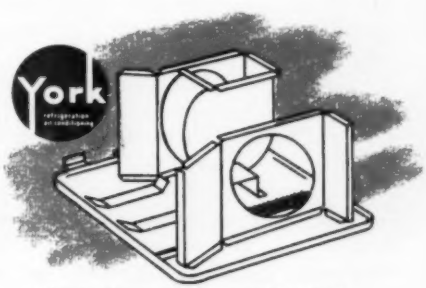
Sciaky Resistance Welding Techniques simplify operations, increase production, and facilitate model change-over at York Corporation

Integrated, standard Sciaky welders and a simple multiple gun welder assemble the entire chassis and wrapper for the one-half, three-quarter, and one ton size York air conditioners.

This Sciaky technique of fabrication, producing 90 assemblies per hour, permits tremendous production increase *without* basic equipment change. And seasonal model change-over is readily accomplished.

Put the Sciaky concept of resistance welding to work on your product ... your result—*more useful work* at *lowest operating cost* with *maximum reliability!*

Write for your free copy of "Resistance Welding At Work", Vol. 4 - #10 for all the details of the development and use of the Sciaky technique of assembly at York.



Sketch of completely assembled York Air Conditioner Chassis.

• • •

Write for Bulletins 338 and 339

The most significant development in the history of resistance welding ... the new Sciaky Predetermined Electronic Counter Weld Control.

Largest Manufacturers of Resistance Welding Machines in the World

SCIAKY

Sciaky Bros., Inc., 4914 West 67th Street, Chicago 38, Illinois, POrtsmouth 7-5600

Half Mile of Hot Weld Flash Trimmed Per Grind

HAYNES STELLITE alloy cutting tools trim red hot weld flash from 3200 automobile wheel blanks without chipping, spalling, or losing their sharp cutting edges. The temperature of the weld is at 1500 deg. F as the tools slice through the flash. During the operation, the tools are subjected to thermal shock as they come in contact with the hot metal . . . and to severe impact as they cut through chilled sections and irregular weld surfaces. Yet they remain in operation for a full 8-hour shift.

Three HAYNES STELLITE alloy tools are used on this job. One rough machines the weld and the following two take finishing cuts. They remove 10½ in. of flash from each wheel blank, and trim a half mile of flash per grind.

HAYNES STELLITE tools remove metal fast. They can be used at high speeds with comparatively high feed rates, and they take deep cuts. They have good impact strength, high compressive strength, and retain their hardness at red heat temperatures. This combination of properties makes them extremely valuable on any machining job.

For information on how HAYNES STELLITE tools can help you speed up your machining operations, write for the booklet "HAYNES STELLITE Metal-Cutting Tools." It gives helpful information on chip formation, tool design, grinding procedures, and the machinability of metals.

"Haynes" and "Haynes Stellite" are registered trade-marks of Union Carbide and Carbon Corporation.

HAYNES TRADE-MARK ALLOYS

HAYNES STELLITE COMPANY

A Division of Union Carbide and Carbon Corporation

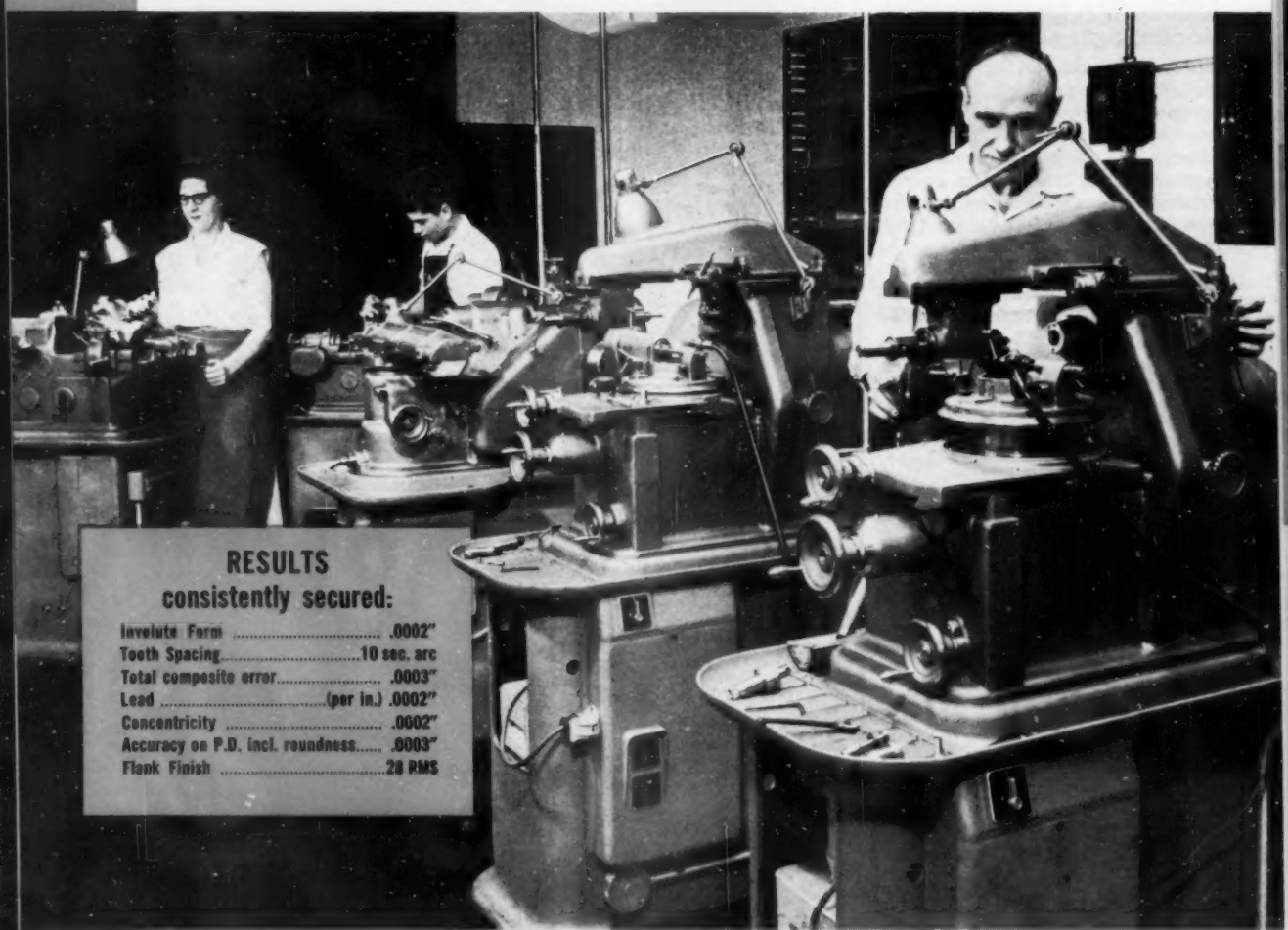
UCC

General Offices and Works: Kokomo, Indiana

Sales Offices

Chicago • Cleveland • Detroit • Houston • Los Angeles • New York • San Francisco • Tulsa

For many years The Franke Gear Works, Inc. of Chicago have specialized in the manufacture of fine pitch gears and gear assemblies. When they wanted more precision, they selected the MIKRON as the ultimate! The illustration shows a portion of a MIKRON cutting department which contains practically the whole range of MIKRON types... for spur, helical, cluster, internal, bevel, racks and thread milling, worms, worm gears and tangential hobbing of throated worm wheels.



RESULTS consistently secured:

Involute Form	.0002"
Tooth Spacing	10 sec. arc
Total composite error	.0003"
Lead	(per in.) .0002"
Concentricity	.0002"
Accuracy on P.D. incl. roundness	.0003"
Flank Finish	28 RMS

Franke chose Mikron over all other available machines because of repetitive accuracy obtainable . . . and without need for laborious and costly nursing of jobs!

Russell, Holbrook & Henderson, Inc.

292 Madison Avenue, New York 17, N. Y.

BROWN & SHARPE—NELCO PLEDGE QUICK SERVICE, GUARANTEED SATISFACTION

Over 3000 quality, expertly designed, engineered and "Industry Endorsed" Carbide, Carbide Tipped and High Speed Steel Cutting Tools will soon be available through the Brown & Sharpe—Nelco distributors. This represents the world's largest line of cutting tools and accessories, manufactured by two of America's most capable and respected manufacturers.

MODERN TOOLING, MODERN DISTRIBUTION!

Modern manufacturing methods, modern machine tools, increased production requirements demand improved tooling service. Brown & Sharpe and Nelco now make the most complete line of the best in cutting tools available to progressive manufacturers everywhere, faster than ever before.

WORLD'S MOST COMPLETE LINE OF CUTTING TOOLS & ACCESSORIES

High Speed Milling Cutters, Cutters, Helical Side Milling Cutters, Spiral Mills, T-Slot Cutters, Keyseat Cutters, Saw Arbors, Cutter Adapters, Collets and Spring Chucks comprise the Brown & Sharpe line.

SPECIALS, A SPECIALTY

Nation-wide distribution and tremendous production capacity guarantee expert attention and prompt delivery for all special cutting tool applications.

TREMENDOUS TOOLING TEAM

Remember: the best in cutter tooling is Brown & Sharpe and Nelco. The easiest and quickest to buy is Brown & Sharpe and Nelco. Remember this tremendous tooling team.

CATALOGS AND PHONE ALL THAT IS NECESSARY

One Brown & Sharpe Cutter catalog, one Nelco catalog and a phone are all that is needed to solve every cutting tool problem. Over 3000 of America's finest cutting tools are at your fingertips, saving anxiety—days of waiting—dollars of extra cost.

Brown & Sharpe NELCO
A Tremendous Tooling Team!

OVER 2300 "INDUSTRY ENDORSED" STANDARD HIGH SPEED STEEL CUTTING TOOLS AND ACCESSORIES!

For the first time, a modern manufacturer with 123 years of metal-working experience is anxious to answer ALL your cutter problems! A total of over 3000 Solid Carbide, Carbide Tipped and High Speed Steel Cutting Tools are as near as your phone.

Call your Brown & Sharpe-Nelco distributor now! Find out how speedily two great names—one great distributing organization—can solve all your "Standard" and "Special" tooling problems. You'll be glad you did—you'll save days and dollars!

BUY THROUGH YOUR LOCAL DISTRIBUTOR!

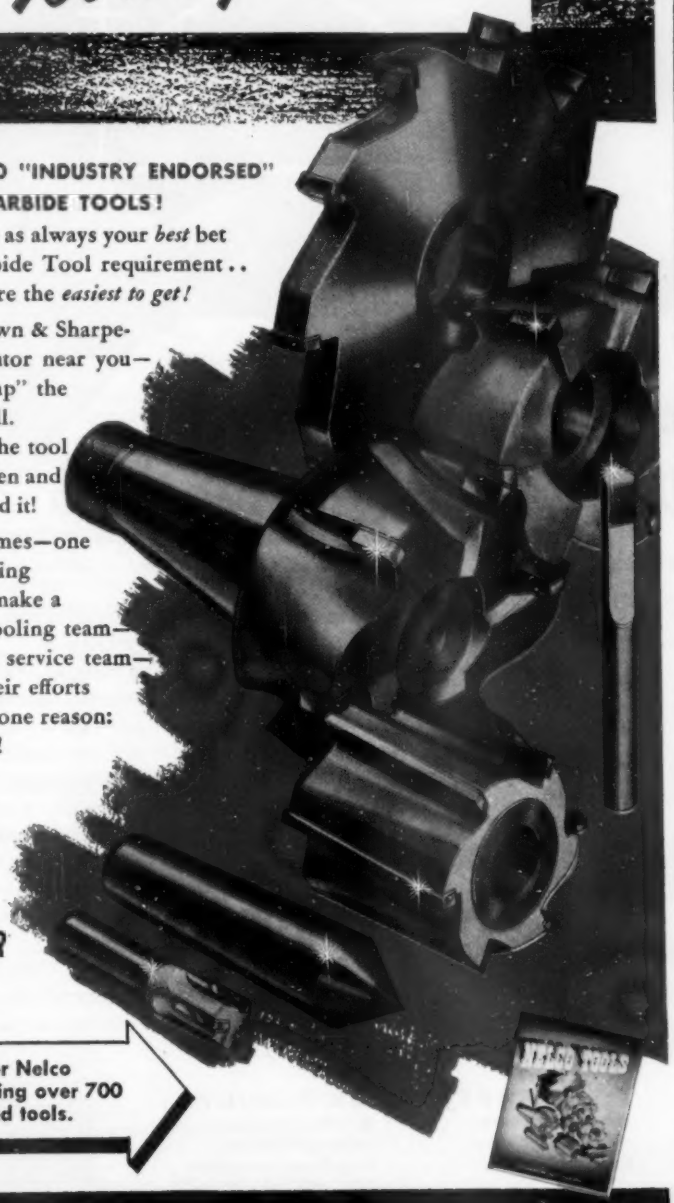
Send for Brown & Sharpe Catalog showing over 2300 High Speed Steel Tools and Accessories

B·S

Brown & Sharpe

BROWN & SHARPE MFG. CO. • PROVIDENCE 1, RHODE ISLAND

NELCO Brown & Sharpe
A Tremendous Tooling Team!



. . . OVER 700 "INDUSTRY ENDORSED" STANDARD CARBIDE TOOLS!

NELCO Tools as always your *best* bet for every Carbide Tool requirement . . and now they're the *easiest to get!*

There's a Brown & Sharpe-Nelco distributor near you—and he'll "jump" the minute you call. He'll deliver the tool you need—when and where you need it!

Two great names—one great distributing organization make a tremendous tooling team—a tremendous service team—combining their efforts and skills for one reason: to help YOU!

CALL YOUR NEAREST DISTRIBUTOR

Send today for Nelco catalog showing over 700 Carbide Tipped tools.

NELCO TOOLS

For that **EXTRA** *Edge on Production!*

NELCO TOOL COMPANY, INC. • MANCHESTER, CONNECTICUT

BROWN & SHARPE—NELCO COMBINE SALES ORGANIZATIONS!

A milestone in metalworking will be reached on September 1st, 1956, when Nelco Carbide Tipped Milling Cutters will become available through the Brown & Sharpe Sales Organization. Complete inventories of Brown & Sharpe—Nelco standard cutting tools will be maintained in every metalworking center, and dependable "milk route" delivery of any Nelco cataloged Carbide or Carbide Tipped Tool as well as any of the complete line of Brown & Sharpe High Speed Steel Cutting Tools and Accessories can be expected.

ANSWERS DEMANDS OF AMERICAN INDUSTRY

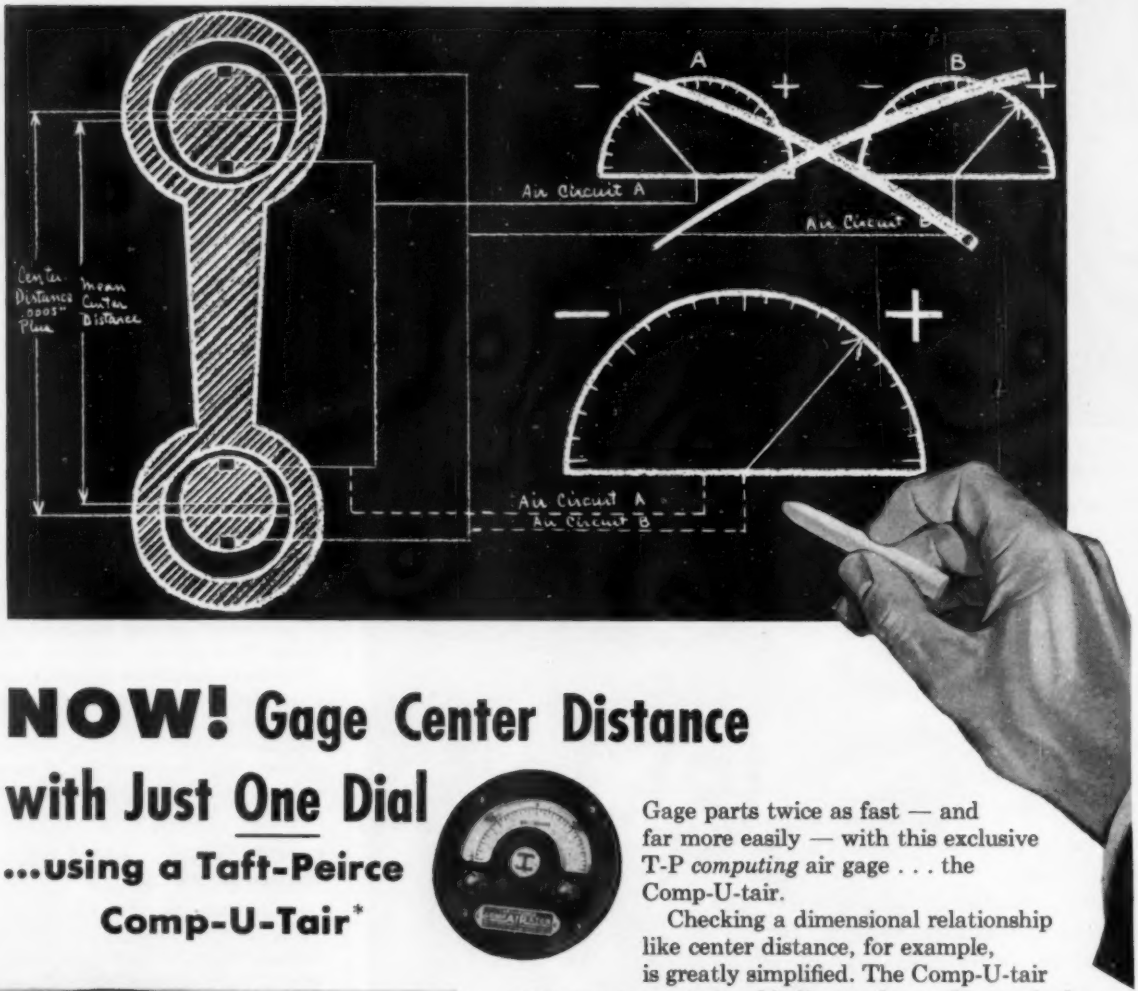
Recognition of the demanding production schedules of industries has made this complete sales cooperation expedient. Overnight delivery of the finest, proven tools available today is a service industry has a right to expect. New machine tools, expanded production commitments, pressure on delivery schedules, demands for reliable tooling have all pointed up the need for a single, dependable, complete tooling source.

NELCO "SPECIAL" TOOLS AT STANDARD PRICES

Carbide Tipped Face Mills, Slab Mills, Boring Bars, Special[illegible]s, Slitting Saws, Cutter A[illegible]- bide Tipped Side M[illegible]e Mills, Cutter A[illegible]eat Cutters, Di[illegible], Shell End Mi[illegible]ace Mills, Grind[illegible] Centers, Tri-He[illegible] Cutters, Carbide Ti[illegible]ills, Solid Carbide E[illegible] Shell Milling Cutter Arbor[illegible] Forged Tools round out the Complete Nelco Line.

SALES, SERVICE, SATISFACTION *GUARANTEED!*

Two of America's foremost manufacturers, continually conscious of quality control, will now make the world's largest standard line of cutting tools for milling machines available to progressive metalworking plants both in the United States and through export channels. A standardization of quality tooling, both Carbide and High Speed Steel, will guarantee speedy service and nonpartisan sales recommendations with the right tools for the right application from a line of more than 3000 "standards!"



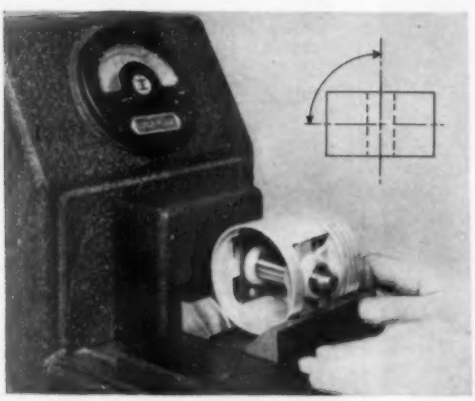
NOW! Gage Center Distance with Just One Dial

...using a Taft-Peirce Comp-U-Tair*

Gage parts twice as fast — and far more easily — with this exclusive T-P *computing* air gage . . . the Comp-U-tair.

Checking a dimensional relationship like center distance, for example, is greatly simplified. The Comp-U-tair measures, computes, and indicates the result on a *single* indicator with *one* pointer. The Comp-U-tair is a *differential air gage*, in which two air circuits are applied to opposing sides of the differential device. Gaging nozzles are placed so that diameter variations cancel each other and have no effect on true center distance reading. Operator reads just one dial, does no calculating, and has an instant, positive indication for every part — in or out of tolerance, plus exact amount and direction of variation.

Streamline your gaging with the unique Comp-U-tair. Call Taft-Peirce to save time and money throughout your inspection operations. As a starter, write for Air Gage Catalog No. 613.



The Comp-U-tair does many other jobs . . .

One big time-saver is measuring squareness, shown above. Squareness is indicated on one *dial* with one *pointer*. The Taft-Peirce Comp-U-tair figures as it measures, can be designed to check several dimensional relationships *simultaneously*. Number of dials is cut in half . . . inspection is faster, more accurate.

*Patent Pending

THE TAFT-PEIRCE FAMILY...

- Magnetic Chucks
- Precision Gages
- Air Gages
- Grinding Machines
- Lapping Machines
- Tool-Room Specialties

TAKE IT TO TAFT-PEIRCE

TAFT-PEIRCE MANUFACTURING COMPANY
WOONSOCKET, RHODE ISLAND

throughout industry—today's job records prove

modern

High Speed Steels

-correctly applied-

show lowest costs

per cu. in. of metal removed

Today's High Speed Steels keep pace steadily with the ever-higher production requirements of American industry. Improvement in quality and advances in heat-treating techniques combine to produce High Speed Steels cutting at speeds 15 to 100% faster than ever before—lasting longer between grinds than ever before!

Tougher than carbides, modern High Speed Steels are *stronger* than carbides, less subject to breakage or edge chipping, *and cost less* than carbides.

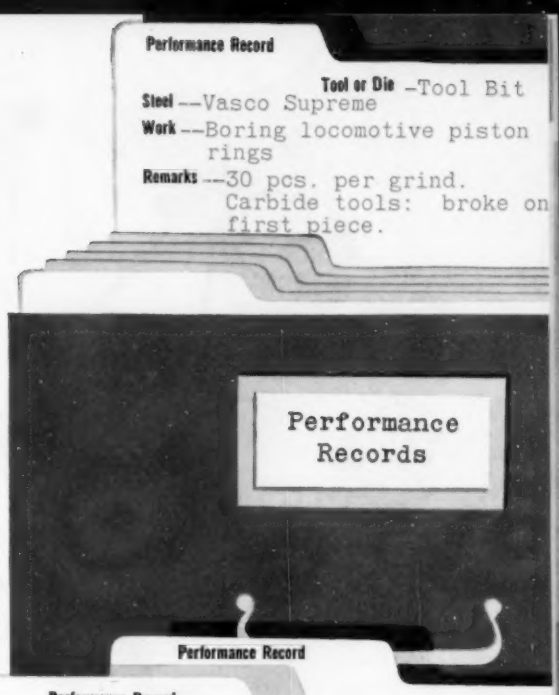
We invite you to join the majority of up-to-date users of cutting tools who specify modern High Speed Steels for 90% of their jobs *and profit* accordingly. Write us for a complete, objective survey of your cutting problems by trained sales engineers.

Vanadium-Alloys Steel Company

Pioneers in the development of M-2 High Speed Steel and High Carbon, High Vanadium High Speed Steels

Latrobe, Pennsylvania

SUBSIDIARIES: Colonial Steel Co. • Anchor Drawn Steel Co. • Pittsburgh Tool Steel Wire Co. • Vanadium-Alloys Steel Canada Limited • Vanadium-Alloys Steel Societa Italiana Per Azioni



Performance Record

Steel --Vasco Supreme **Tool or Die** --Tool Bit
Work --Boring locomotive piston rings
Remarks --30 pcs. per grind. Carbide tools: broke on first piece.

Performance Record

Steel --Vasco Supreme **Tool or Die** --Rough Facing Tool
Work --Rough & finish facing cast connecting rods.
Remarks --28 pcs. per grind, 150 pcs. per tool. Carbide, 8 pcs. before breaking.

Performance Record

Steel --Neatro **Tool or Die** --Core Die
Work --Molding iron powders
Remarks --Replaced carbide on basis of cost and performance.

Performance Record

Steel --Vasco Supreme **Tool or Die** --Lamination Die
Work --Blanking .025" sheet
Remarks --230,000 pcs. per grind: 10,000,000 pcs. per die. Carbide: die broke at 33000 pcs.; another at 550,000 pcs.

Performance Record

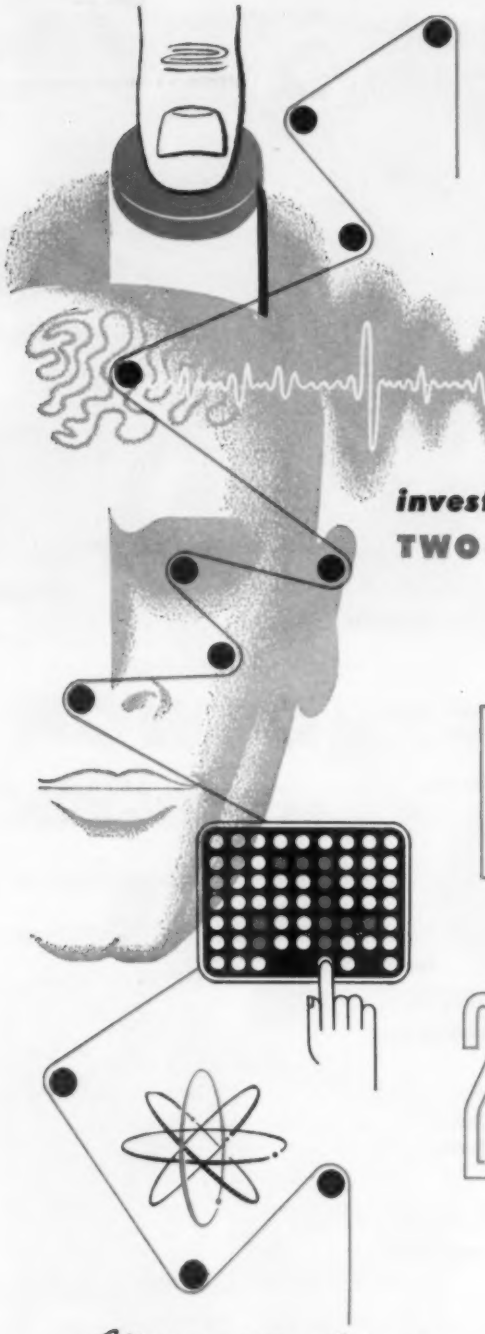
Steel --Vasco Supreme **Tool or Die** --Scalping Die
Work --Removing surface of brass, bronze and copper tubing
Remarks --199,000 ft of tubing and still in good condition. Carbide: broke at 141,000 ft.

Performance Record

Steel --Vasco Supreme **Tool or Die** --Tool Bit
Work --Turning cold rolled C-115
Remarks --Produced twice as many pieces per tool as carbide tools, at rate of 3600 pcs. per day.

Performance Record

Steel --Red Cut Superior **Tool or Die** --Form Cutter
Work --Form cutting bearing races
Remarks --1st day of test: Vasco Supreme 157 pcs.; Red Cut Superior 100 pcs.; carbide 35 pcs. 2nd day: Vasco Supreme 193 pcs.; Red Cut Superior 126 pcs.; carbide 35 pcs.



need creative automation assistance?

investigate W. F. & JOHN BARNES TWO-FOLD AUTOMATION SERVICE

1 ENGINEERING COMPLETE PRODUCTION-LINE SYSTEMS

Complete service includes planning step-by-step sequence of operations and the individual engineering of processes, methods and equipment to meet your production needs. Barnes' creative engineering, developed over a period of 80 years in designing and building high production machine tools, can be depended upon to provide you with the latest in cost-cutting methods. Our highly versatile engineering staff will work with you as a team to solve problems quickly and efficiently.

2 DESIGNING AND BUILDING SPECIAL UNITS

To meet specific work-handling or processing needs, Barnes' engineers have designed and built special conveyors, turn-over mechanisms, inspection, and assembling equipment to suit either automatic or semi-automatic requirements. Hundreds of units are today profitably serving a wide range of industries. Because electrical, hydraulic, mechanical, tool and fixture engineering is closely coordinated at Barnes under one roof, you save time and eliminate divided responsibility.

Write for Free Literature

Ask for Production Analysis

Find out today why more and more production executives are turning to Barnes for help with their automation problems. Barnes' creative engineering staff will be pleased to analyze your requirements, offer recommendations, and provide you with a cost estimate in a formal proposal, if you desire.

Builders of Better Machines and Equipment since 1872

W. F. & JOHN BARNES

AUTOMATION SECTION

431 S. WATER ST. • ROCKFORD, ILLINOIS

SPECIAL MULTIPLE SPINDLE MACHINE TOOLS • SPECIAL PROCESS EQUIPMENT • SPECIAL ELECTRICAL CONTROLS

Quality and service are the unseen ingredients in the steel that JESSOP makes

For 55 years in America and more than a century before that in England, the name Jessop has stood for high-quality specialty steels. This year with production at an all-time high and orders pouring in from good customers, new and old, one might assume that a company in Jessop's position would become complacent . . . would sit back and reap the harvest from former efforts, and rely on diplomacy to excuse slower deliveries.

Not so with Jessop. Jessop is a young and aggressive organization with a determination for absolute leadership. With business booming, Jessop is about to complete the first phase of an ambitious building program involving mills, furnaces, machines and, above all, good technical men. Jessop means to be sure that, as the tide of production rises, quality and service will not recede. Look at the list of products below. This is a good time to become a Jessop customer.

STAINLESS STEELS • HIGH SPEED STEELS • NON-MAGNETIC STEELS HIGH SPEED TOOL BITS • HEAT RESISTING STEELS • STAINLESS-CLAD PLATES • CARBON AND ALLOY STEELS • TOOL STEELS FOR SPECIAL PURPOSES • CAST-TO-SHAPE TOOL STEELS • HIGH SPEED AND ALLOY SAW STEELS • TEMPERED AND GROUND STRIP STEEL • COMPOSITE HIGH SPEED STEELS • STAINLESS AND HEAT RESISTING CASTINGS • COMPOSITE DIE STEEL SECTIONS • PRECISION GROUND FLAT STOCK • DIE STEELS—HOT AND COLD WORK

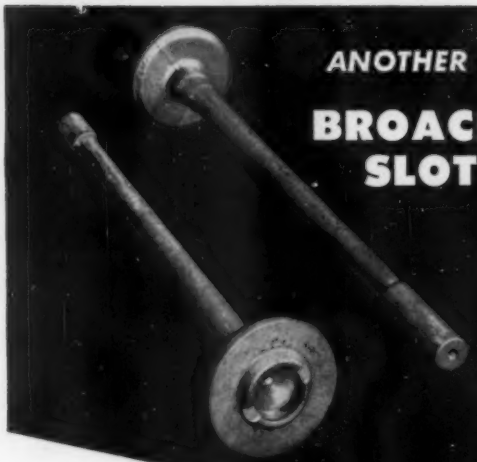
JESSOP

STEEL COMPANY · WASHINGTON, PENNSYLVANIA

OFFICES IN PRINCIPAL CITIES

Jessop Steel of Canada Limited, Wallaceburg, Toronto

Jessop Steel International Corp., Chrysler Building, New York, New York

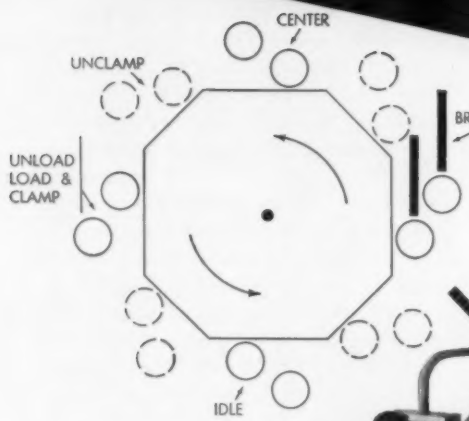


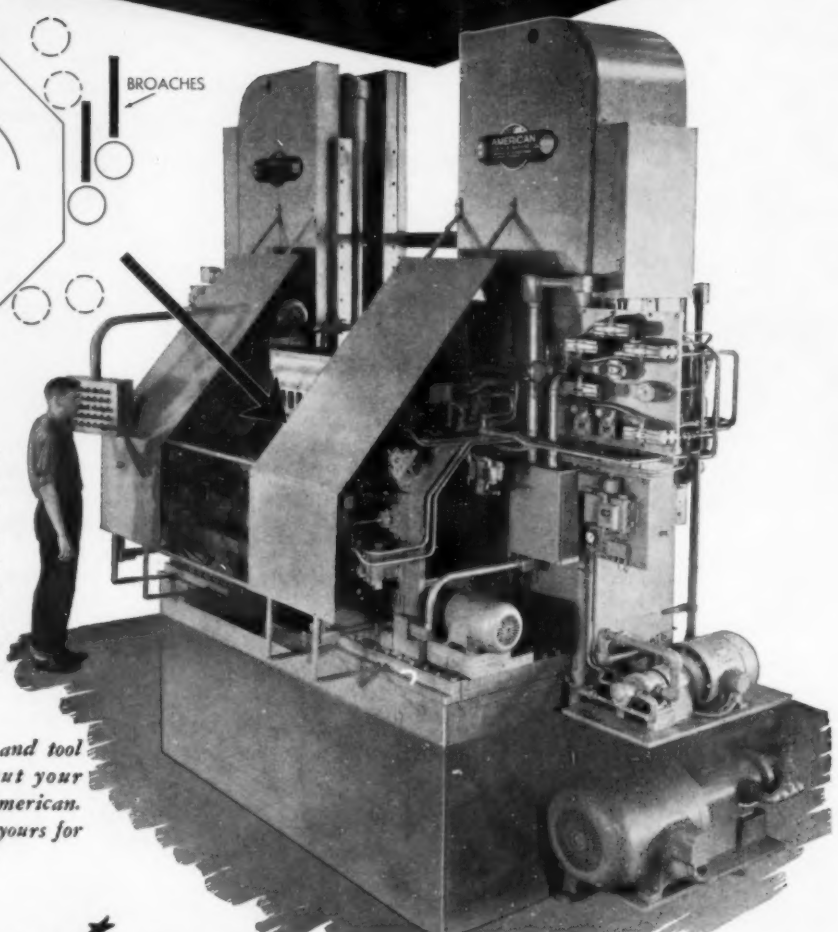
ANOTHER *American* FIRST

BROACH SHAFT ENDS
SLOT FLANGE ENDS
CENTER DRILL
BOTH ENDS

2 axle shafts every 30 seconds

Axle shafts of two different lengths are simultaneously broached at both ends and then center drilled on this American double column broaching machine. With a 30-second cycle, including 8 seconds for unloading and reloading by the operator, a production rate of 240 parts per hour is made possible.





A major tooling feature is an 8-position, drum-type indexing unit, equipped with four 2-station work holding fixtures. With the machine operating on the automatic cycle, operator reloads while broaching and center drilling is in progress at the other stations.

For the top-notch machine and tool engineering that will cut your broaching costs, contact American. American's Catalog 450 is yours for the asking.

AMERICAN

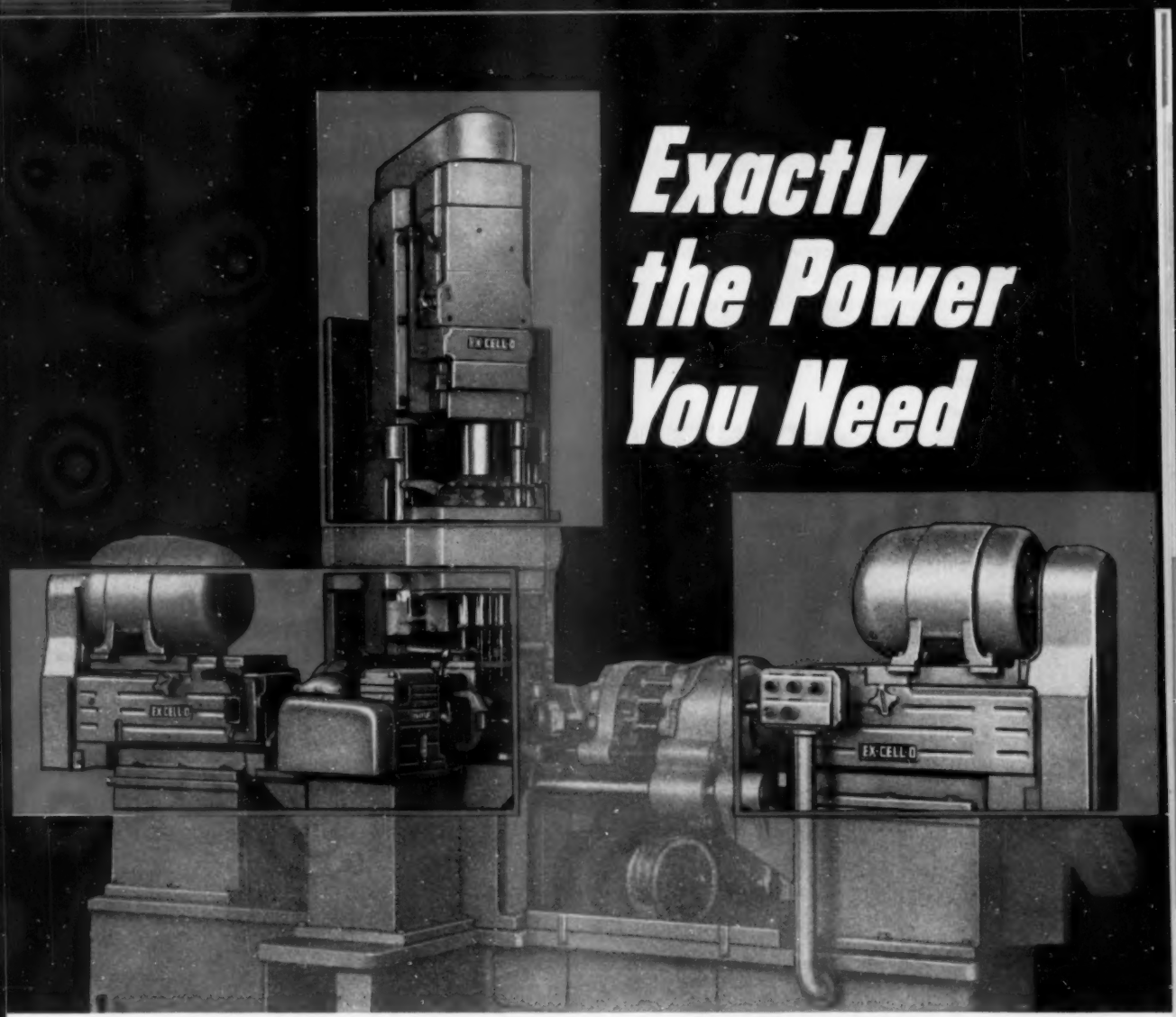
American BROACH & MACHINE CO.

A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

ANN ARBOR, MICHIGAN

SUNDSTRAND

See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery



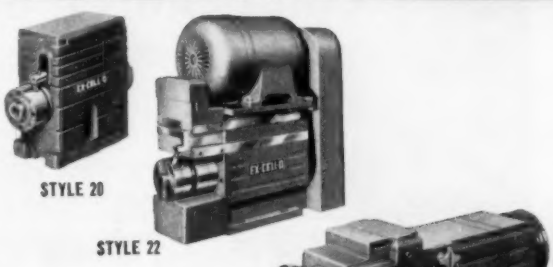
Range of horsepower, stroke, spindle speed and thrust in Ex-Cell-O Quill Type Power Units

Ex-Cell-O Hydraulic Power Units come in sizes suitable for a wide range of applications. Compact design makes it possible to place them at close center distances either in line or radially around a fixture. No matter what the application, you get smooth, dependable operation.

Used in drilling, counterboring, spot-facing and reaming operations, these hydraulic power units can be designed into special-purpose machines with easily controlled automatic cycles. Units can later be re-arranged to perform different machining operations.

You can install these power units easily. They'll stand up under fast cycles and continuous operation; they're self-lubricated.

For complete information ask your Ex-Cell-O representative or write Ex-Cell-O in Detroit.



EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

EX-CELL-O FOR PRECISION

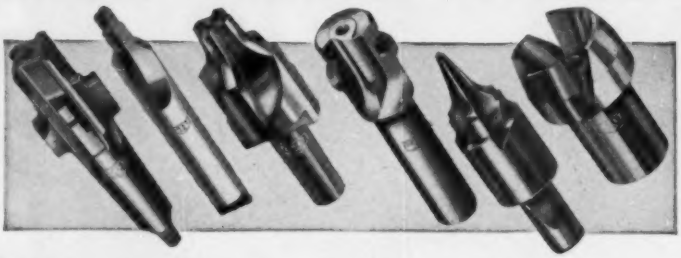
XLO

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

56-45

Special Cutting Tools OF DEPENDABLE QUALITY

The Detroit Reamer & Tool Co. Plant is equipped with the finest in modern machinery and inspection facilities to provide you with the ultimate in precision tools. Our Engineering and production personnel with 35 years of empirical knowledge behind them are completely qualified to expertly handle your tool needs.



Grip-Tip CENTERS with Replaceable Carbide Tips

(PATENTED)

CHECK
THESE
Grip-Tip FEATURES
● Long-Life Holders
● Replaceable Carbide Tips
● Easy Insertion and Removal of Male or Female Tips
● Reduced Machine Down-Time
● Lower Cost for Replacement of Carbide Tips
● Carbide Tips Accurate to .0003"
● No Regrinding of Holder
● Carbide Tips Are Easy and Inexpensive to Stock
● Reduced Regrinding Time
● Longer Diamond Wheel Life

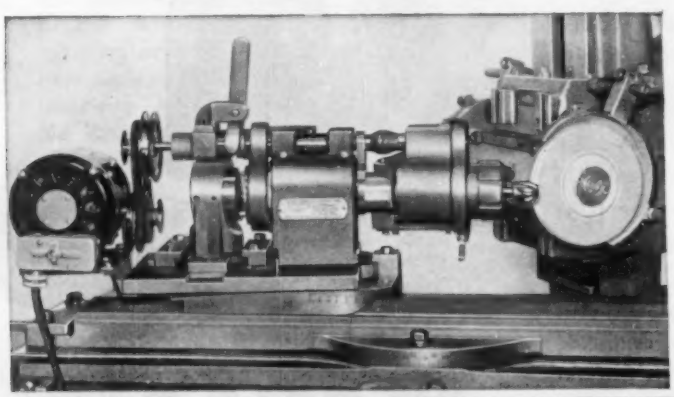
Grip-Tip Centers are designed to substantially reduce your replacement costs and machine downtime for regrinding or replacement of worn or chipped centers.

Male or female tips are inserted or removed from tool steel holders by simply turning clamping screw . . . you save replacement time.

The life of Grip-Tip holders is practically unlimited . . . only the tips are reground. Also, double end tips are relatively inexpensive . . . they reduce tool and inventory costs.

It takes but a minute to remove and replace tips . . . machine tool downtime is less with Grip-Tip.

CIRCULARITY GRINDING ATTACHMENT



Circularity-Grinding Attachment illustrated permits your own tool makers to quickly and easily answer your production requirements for new cutting tools. With this attachment, new cutting tools can be quickly cut from raw stock, old tools converted to meet new requirements or standard tools reground to your specifications. The Circularity Grinder is of inestimable value when emergencies exist, demand for a new tool is urgent or production lines must be kept running. With this attachment in your shop you eliminate delayed deliveries.

DETROIT REAMER & TOOL CO.

780 WEST MAPLE ROAD • P.O. BOX 174 • BIRMINGHAM, MICHIGAN

D R & T COMPANY

CUSTOMER SPECIFIED

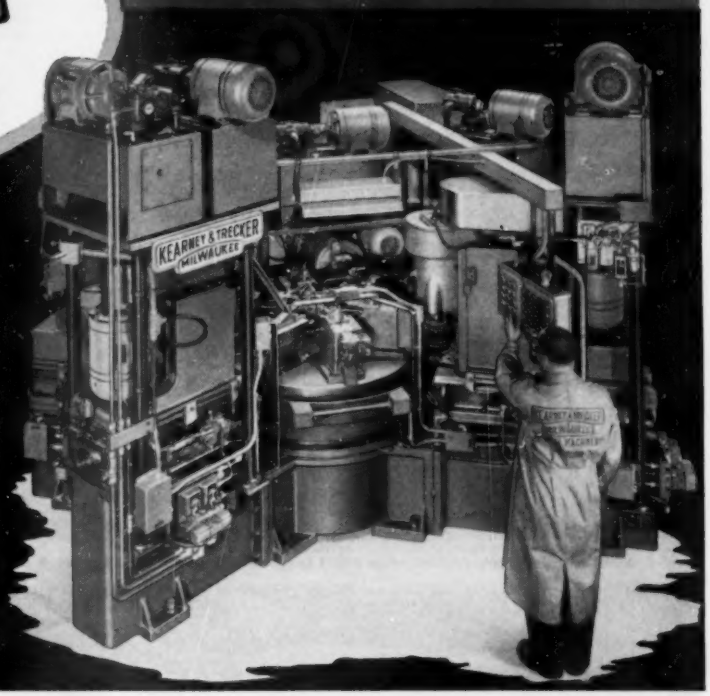
One of the nation's leading manufacturers of communications equipment needed a way to increase production milling of telephone relay frames, reduce unit costs and greatly improve product quality. They called on Kearney & Trecker to solve this problem.

...indicates machined surfaces.

KEARNEY & TRECKER MILWAUKEE® DESIGNED

Here's Kearney & Trecker's answer: Two 6-Station Rotary Indexing machines which mill 24 surfaces on cast iron telephone relay frames within plus or minus .002" at a combined rate of 360 pieces per hour. Former methods produced only 150 relay frames per hour.

An important cost-saving feature of each machine is the application of standard units — five feed slides and a 48" rotary index table. Such utilization of standard units lowered initial costs, simplified maintenance and increased efficiency.



High-volume, low-cost production starts with Kearney & Trecker Milwaukee machine tools

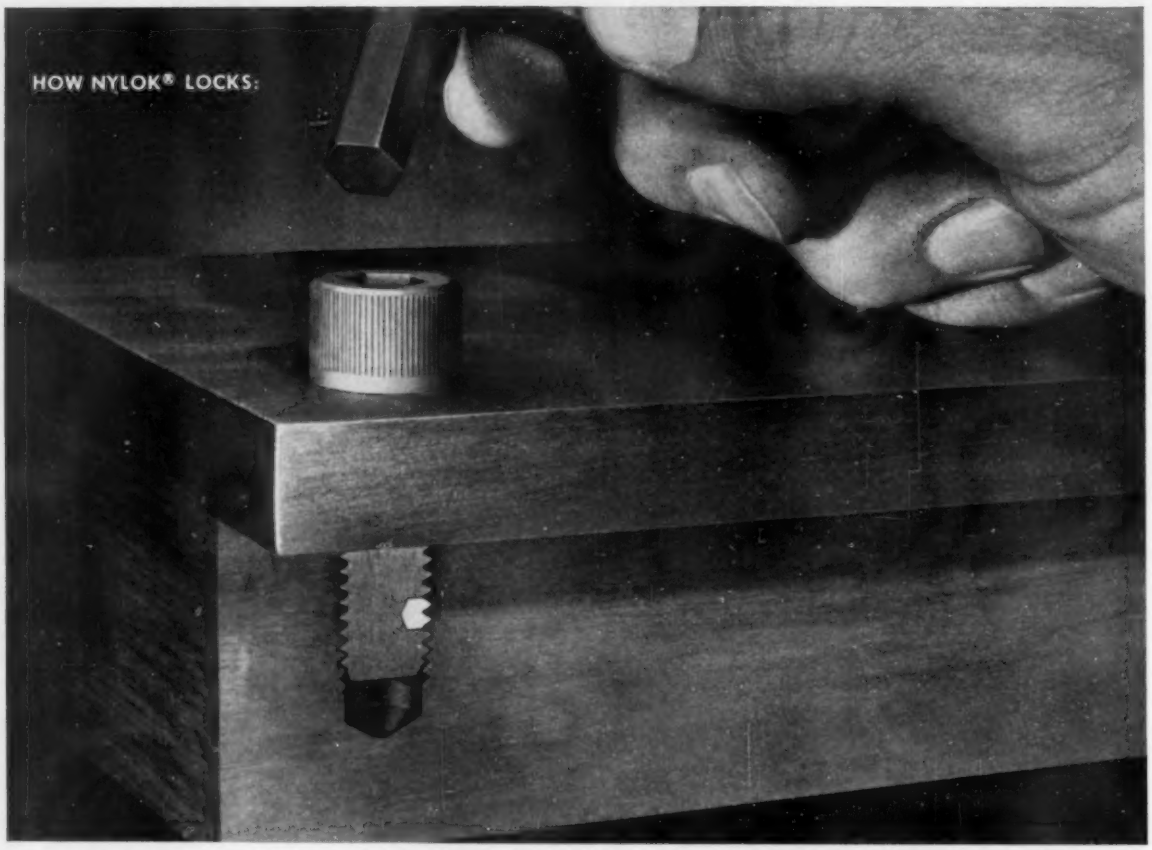
Kearney & Trecker automatic production machines accurately perform many operations at lower cost. But most important to you, this is accomplished by combining standard design components — feed slides, way-type drill units, tapping units, quill feed units, rotary index tables — that keep initial machine costs at a minimum. You get the production you want and the economies you need from job-proven designs. What's more, you get performance to exacting accuracies.

Take advantage of our abilities. See how they can pay off in new profits for you. Whatever your production machine needs, call our representative or write: Special Machinery Division, Kearney & Trecker Corp., 6772 W. National Ave., Milwaukee 14, Wisconsin.

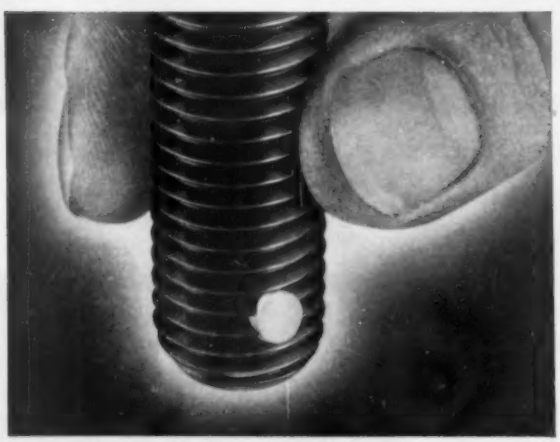
For more information on machine illustrated, ask for Data Sheet No. 1083. A new bulletin, SMD-56, which describes many of our outstanding machine designs, is also yours for the asking.

Designers and Builders of Precision and Production Machine Tools Since 1898

NEW—a complete line of socket screw products



LOCKED! The tough, resilient nylon pellet keys itself into the mating threads. It forces threads together, and locks the screw securely.



BEFORE ASSEMBLY. The nylon pellet projects slightly beyond male threads. When assembled, female threads will be impressed into it. Pellet locks effectively whether the screw is seated or not.

AFTER REMOVAL. "Plastic memory" of pellet has expanded impressed threads to greater diameter than screw threads. Screw can be used repeatedly. In use, "memory" keeps threads tightly locked.

self-locking UNBRAKO that won't work loose

They simplify design and save production time

UNBRAKO socket screws are now available embodying the Nylok* self-locking principle. Nylok provides a truly practical new solution to the problem of making screws self-locking.

An UNBRAKO screw with Nylok is a single self-locking unit. No auxiliary locking devices are needed. Just thread the UNBRAKO into any tapped hole. *Seated or not*, it locks positively wherever wrenching stops. The tough, resilient nylon pellet forces mating threads together and holds tight. The screw will not shake loose.

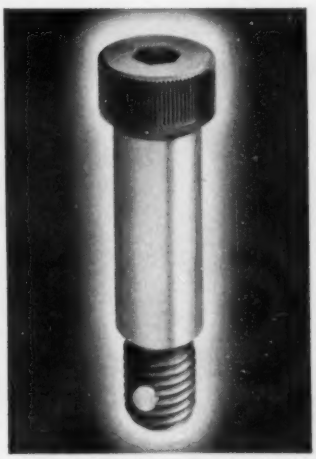
You save production time when you build products with self-locking UNBRAKOs. And you get greater simplicity in design with less bulk and weight. The number of parts you must assemble to achieve full locking action is reduced to the absolute minimum. Lockwashers under screw heads are no longer necessary. Costly wiring of cross drilled heads is eliminated. So are cotter pins and complex multiple set screw installations.

Self-locking UNBRAKOs are completely reusable. They have uniform locking and installation torques—with no galling or seizing on mating threads. They successfully withstand temperatures from —70° to 250°F. And, on properly seated screws, the pellet acts as a liquid seal.

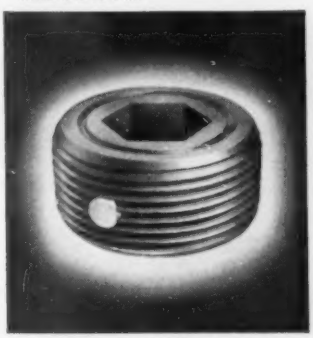
Self-locking UNBRAKO socket screws come in a complete range of standard sizes and materials. See your authorized industrial distributor. Technical data and specifications are detailed in Bulletin 2193. Write us for your copy today. Unbrako Socket Screw Division, STANDARD PRESSED STEEL CO., Jenkintown 37, Pa.

**T.M. Reg. U.S. Pat. Off., The Nylok Corporation*

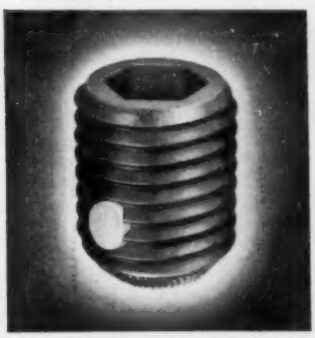
Socket head cap screws. Standard sizes # 6 to 1 in.



Socket shoulder screws. Standard sizes ¼ to ¾ in.

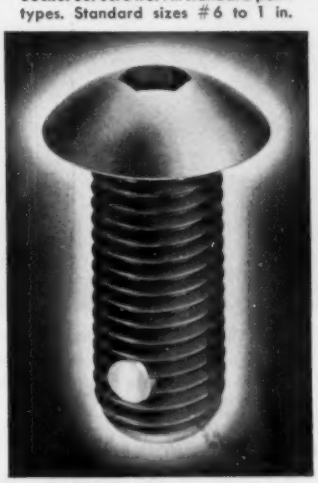


Socket pressure plugs. Standard sizes ⅛ to 1¼ in.



Socket set screws. All standard point types. Standard sizes # 6 to 1 in.

Flat head socket screws. Standard sizes # 6 to ¾ in.



Button head socket screws. Standard sizes # 6 to ⅜ in.

UNBRAKO SOCKET SCREW DIVISION

STANDARD PRESSED STEEL CO.

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Another Opportunity Chemical from General Mills

Tough, easy-to-use cut tooling time

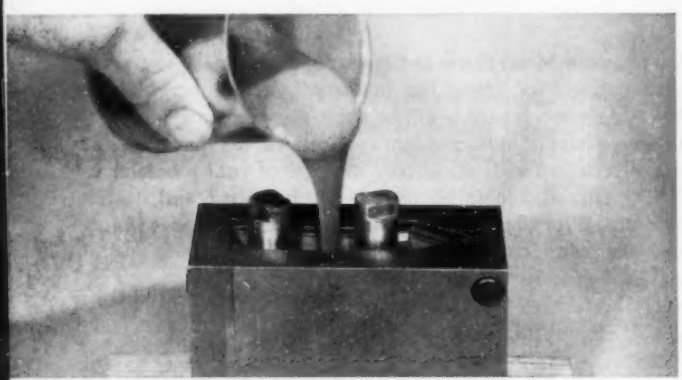
Versamids are tough, resistant to wear and can be fabricated with a fewer number of highly skilled workers. Reinforced epoxy tools eliminate completely the need for such high cost operations as machining, grinding and polishing. These aluminum stampings were made with a Versamid-epoxy drop-hammer die by the McDonnell Aircraft Corp. of St. Louis.

Investigate Versamids, the versatile polyamide resins, made only by

CHEMICAL DIVISION

Versamid-based alloys and costs up to one-half

The answer to more profitable production today lies in greater speed, reduced costs. That's why automotive, aircraft and other industries demanding perfect performance are replacing many metal tools and dies with those made of Versamid-based alloys. In addition to saving as much as 50 percent in tooling time and costs, plastics are four to five times lighter than metal, have great strength and impact resistance, shrink little in casting and accurately transfer the most complex surfaces with practically no change in dimension. Before you retool, look into Versamids. They have a place on your production line to save time and money.



Here an alloy of Versamid-epoxy and aluminum powder is poured into a brass mold to form a chuck section for a lathe. Versamid-epoxies are castable at room temperature, cure quickly. They can be used for large castings since relatively little heat is given off when the epoxy is mixed with Versamid polyamide resin.

Holding this odd-shaped piece-part in ordinary locking devices for machining was unsuccessful. The problem was solved with a quick, simple casting of the vice-jaw from Versamid-epoxy. Versamids are non-toxic, non-porous, resistant to oil, water and cleaning chemicals. They can be formulated to yield almost any set of properties desired.

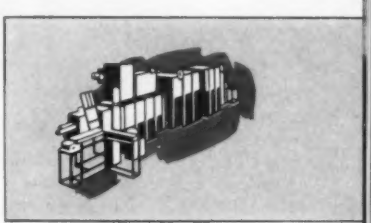
The thin shoulder on this Versamid-epoxy forming punch is reinforced, providing more than enough strength for limited production. Because they need no costly grinding or machining and have great dimensional stability, Versamid dies are the low cost answer to short run production of piece parts normally calling for intricate, metal dies.

A recent issue of *Progress thru Research* tells the story of profitable plastic tooling, how it applies to your operation. Write Chemical Division, Dept. TE10, General Mills, Kankakee, Illinois.

OF General Mills KANKAKEE, ILLINOIS

If it has anything to do with the application of heat to Industry. . . .

When you're at the Metal Show in Cleveland, please make it a point to visit headquarters for "Heat For Industry," the Lindberg exhibit in Booth 431. All our top people will be there, engineers, metallurgists, experts in every phase of industrial heat applications. It's quite possible that they can come up with the answer to some of your problems in this field. The latest Lindberg equipment will be shown and, particularly, we'll unveil for the first time a brand-new development in furnaces that we're confident will fill an important place in the heat treating field. Whatever your job may be, if it has anything to do with the application of heat to industry, it's worthwhile talking to Lindberg. So see us at the Show!

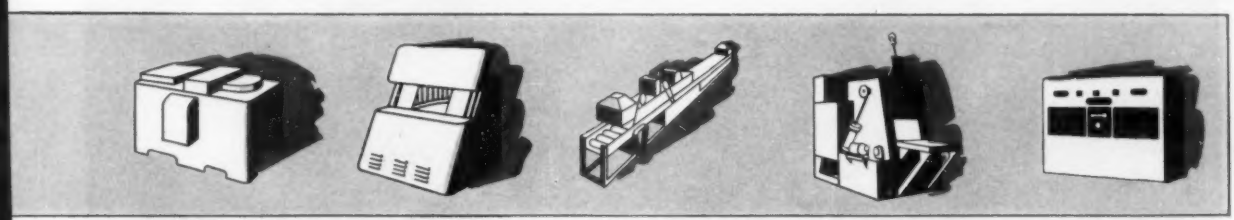


Ceramic Kilns

. . . . . BETTER TALK IT OVER WITH

LINDBERG

The safest way to be sure that you have the right answer for any application of heat to industry is to talk it over with the most widely experienced experts you can find. We believe we have them here at Lindberg. Our business is concerned only with the development of industrial heating equipment and we manufacture the most complete line in the field; heat treating furnaces, melting furnaces, high-frequency induction units, ceramic kilns; big ones, small ones, electric or fuel-fired, built in our plant or field-erected. Before you decide on any application of heat to industry, it's reassuring to know you have the right answer. Talk it over with Lindberg.



Melting Furnaces | Laboratory Furnaces | Field-Erected Furnaces | Carbonitriding Furnaces | Induction Heating Units

Here are some specific advantages you get only when you come to Lindberg:

- An organization of experts concentrating only on the development of industrial heating equipment.
- The most *complete* line of equipment insuring the recommendation of exactly the right methods for your specific product requirements and production processes.
- Research and development laboratories which have originated and perfected many important heating methods and processes. Among these are the Cyclone tempering furnace, automatic control of carbon potential in furnace atmosphere . . . 60 cycle induction melting . . . completely automatic ceramic kilns . . . the "Iron Lung" for treating stainless steel . . . vertical replaceable radiant tubes . . . CORRTHERM electric heating elements and many other innovations in the industrial heating field.
- A design committee of the country's top furnace and process engineers which, in cooperation with many of our good customers, has been responsible for such important developments as the high frequency method of heat treating automotive valves, rotary furnaces for forging and annealing titanium, reverbatory furnaces for aluminum and the automatic carbonitriding furnace universally recognized as the leader in the field.
- A world-wide organization of subsidiary companies, making available to Lindberg the latest developments in heat applications in foreign industry.
- A group of technically-trained Field Representatives locate. in fifteen industrial centers in the United States. There's trained Lindberg man just as close as your telephone.

You can't afford not to get the best advice possible on your industrial heating problems. We are confident our experience can be helpful to you. Why not talk it over with Lindberg?

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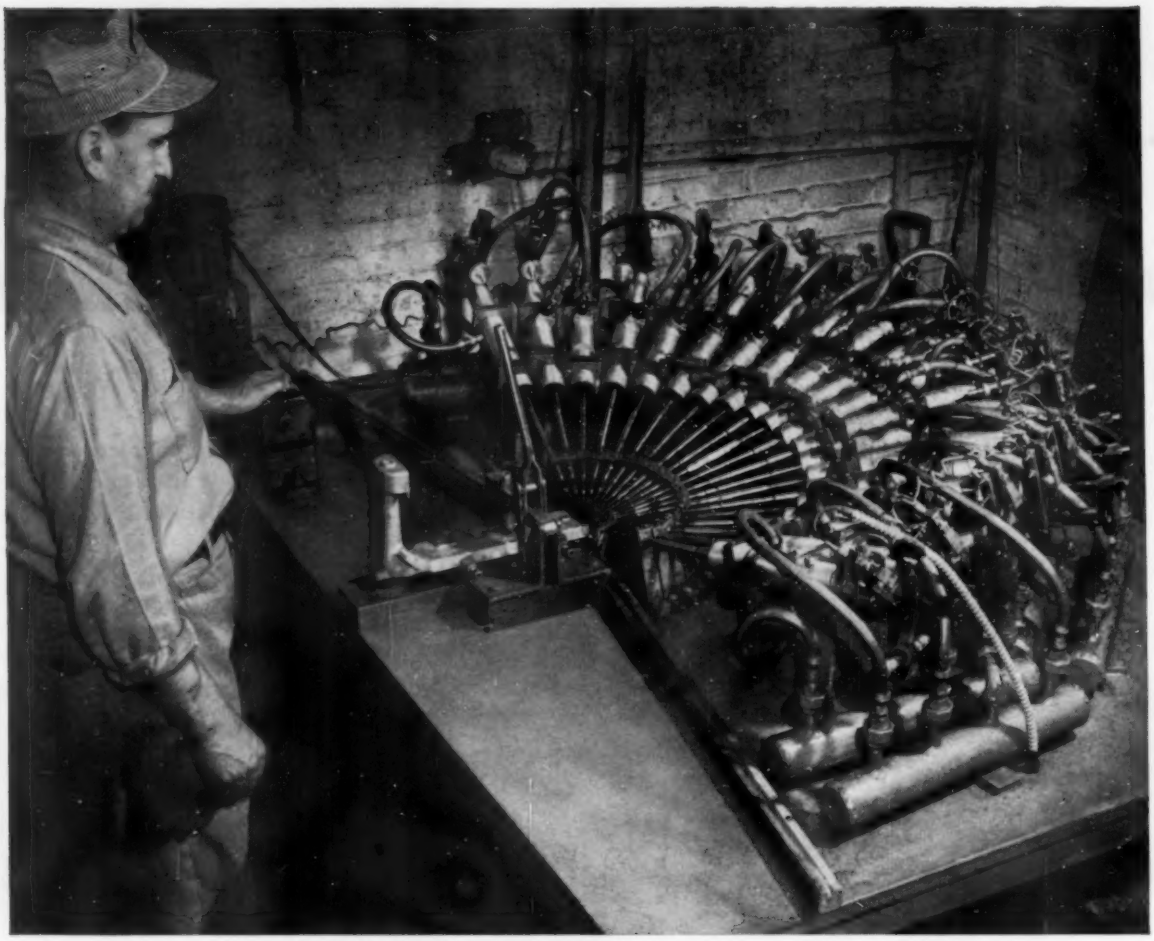
Gardner Denver . . . Serving the World's Basic Industries



Showing how the Airfeedrills are held in the fixture and how the burner casting is mounted in the jig. Manifolds, which assure proper air volume, are mounted on the bench around outside of tool fixture.

Press a button . . . 20 drilled holes! Use Keller Tool time-saver Airfeedrills

Hole drilling on this gas burner was a time-killer before Keller Tool Airfeedrills® took over. The job was formerly hand-indexed for each of the 20 holes. The drill press spindle was hand-fed for each hole.

Operator now presses the button on a 4-way air valve. Presto, 20 drilled holes in a 40-second cycle—automatically. The drills start simultaneously, advance, drill the holes, retract and shut off—automatically.

Keller engineering ingenuity + Keller air tools = production cost reductions. How about investigating?

GARDNER - DENVER

KELLER TOOL division, Grand Haven, Michigan

THE QUALITY LEADER IN COMPRESSORS, PUMPS, ROCK DRILLS AND AIR TOOLS FOR CONSTRUCTION, MINING, PETROLEUM AND GENERAL INDUSTRY

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When you specify Taps or Gages *by Card*, you know you're getting the finest. Card's long experience in the manufacture of precision tools is your guarantee of satisfaction. In every industry the superior performance of Card taps and gages is speeding production, helping to turn out better products faster.

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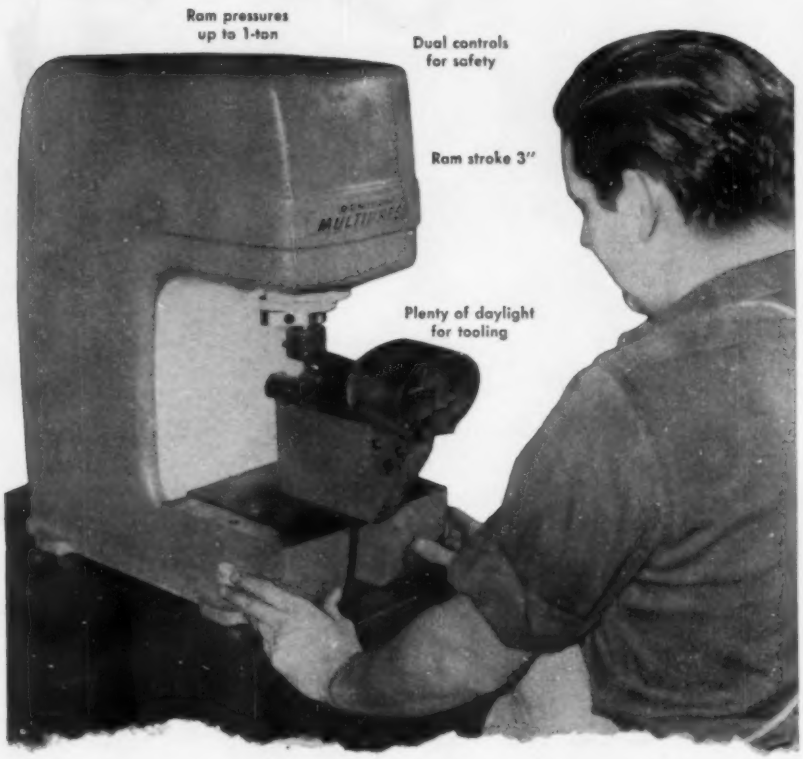
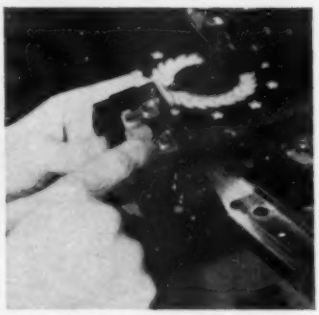
FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE A-10-65

HOW TO SIMPLIFY PRESSING OPERATIONS

...assembling – riveting – marking – trimming – broaching – punching





PREVENTS BREAKAGE of plastic units in riveting of metal inserts.

ELIMINATES SCRAP in assembly of bearings at rates of 200 to 300 per hour.

SPEEDS ASSEMBLY of brass cone to steel stem... 800 to 900 per hour.

easily tooled for any pressing job

DENISON 1-ton hydraulic *MULTIPRESS*®

now gives you:

More production per hour with extremely fast cycle time . . . without kicking pedals or pulling levers.

Uniform quality production with accurately duplicated ram pressure on every stroke.

Maximum safety with interlocking controls to prevent accidental tripping.

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MAIL DATA FORM to see how you can benefit

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MY APPLICATION

Type of Operation	*Type of Material*
☐ Assembling	☐ Steel
☐ Marking	☐ Brass
☐ Punching	☐ Aluminum
☐ Trimming	☐ Plastic
☐ Broaching	☐ Glass

☐ Have Salesman Call

Company Name _____
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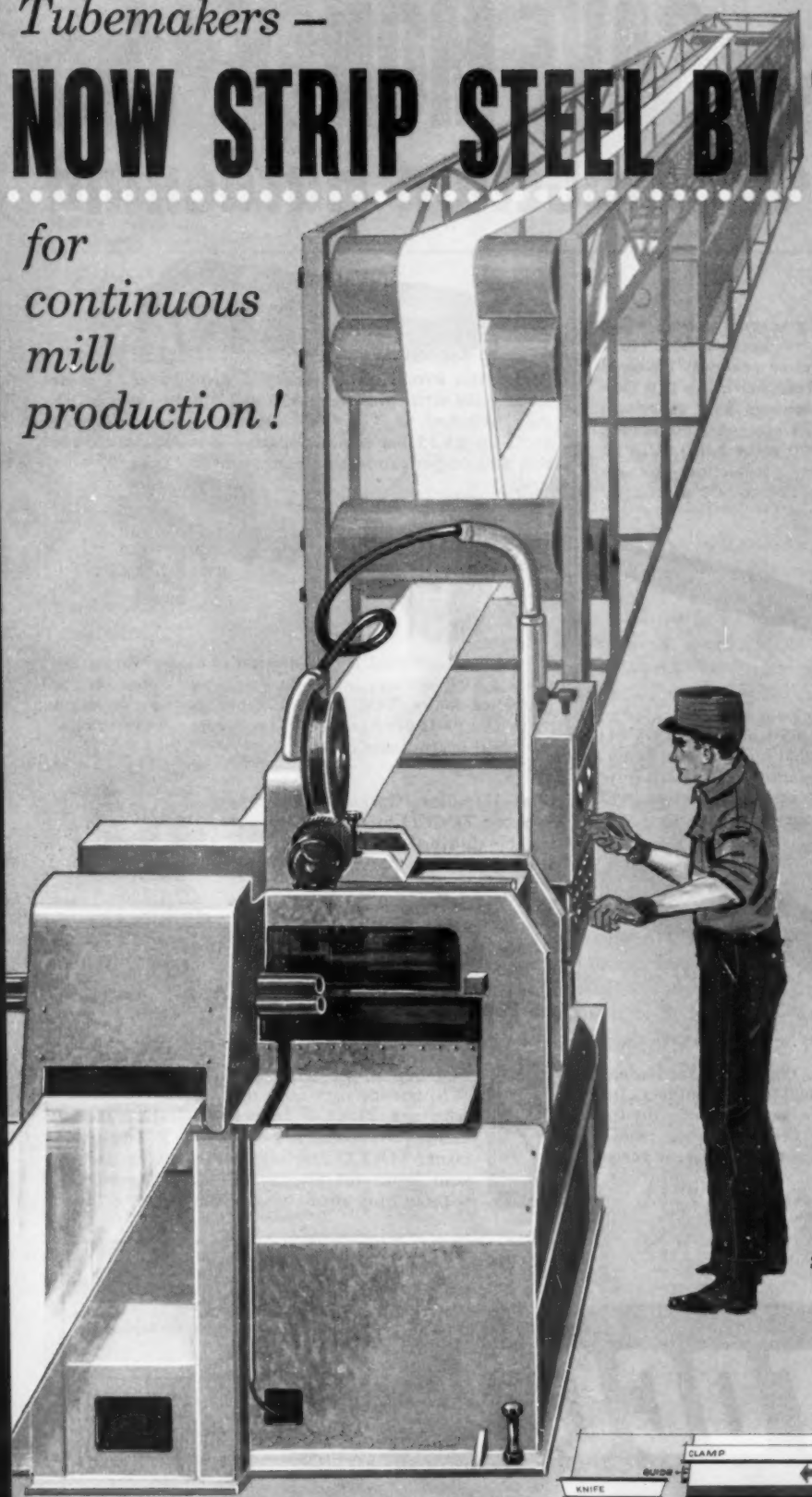
Tubemakers –

NOW STRIP STEEL BY THE MILE

for continuous mill production!

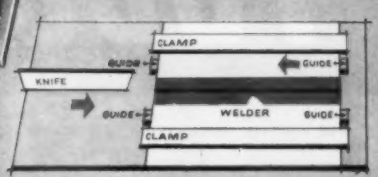


The "MPM SHEAR WELDER" is "a natural" for increasing output and reducing coil end scrap loss.

Perfect welds are a result of positive guiding and clamping, right at the weld area. *(See diagram below.)* Both shearing and welding are done at the same station.

The "MPM" is the fastest, most accurate and compact machine of its kind, that's why tubing manufacturers prefer them over any other type. They are available in a complete range of sizes for any tube mill application. Other types are available for joining strip or sheets of any metal.

Metal Processing Machine Co.
Subsidiary of The McKay Machine Co.
YOUNGSTOWN, OHIO



McK
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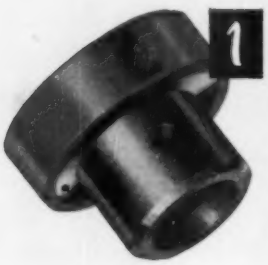
10092

7 WAYS to SAVE MONEY with TOCCO* Induction Hardening

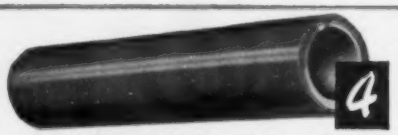


Cost was reduced 94% when heat-treatment of this corn-harvester part was changed from carburizing to TOCCO-hardening, 9½c saved on every piece — $4750 on each 50,000 piece batch, plus an hourly production increase from 120 to 300 pieces per hour.

Leading automotive companies need and use TOCCO hardened axle shafts to handle higher horsepower. Better, yet cheaper—savings of $375.00 per day. Less machining costs, lower priced material, increased production, and a plus in quality—200% greater torsional life.

Kearney & Trecker Corp. reduced the cost of hardening this milling machine part from $1.57 to 10c apiece. In addition TOCCO made possible a switch from alloy to S.A.E. 1045 steel—saving another 11c per piece in material cost. Kearney & Trecker hardens 140 different parts on one TOCCO unit.

See Us At Booth 2212
National Metals Exposition
Cleveland — October 8-12



Thompson Products Ltd. boosted production of these automotive wrist pins from 500 to 1200 per hour when they switched to TOCCO-hardening. Costs fell from $5.45 to $3.25 per hundred parts—a savings of 2c per pin, $26.40 per production hour.

Mechanics Universal Joint Division of Borg-Warner reports a 69% savings in the hardening of stub ends for propeller shafts. TOCCO also upped production from 35 to 112 parts per hour—over three times as fast as conventional heating methods.

Lima-Hamilton Corporation adopted TOCCO for hardening this shifting lever. Results: a savings of 4c per piece—$25 per production hour. TOCCO costs only 17% of former heating method. This is only 1 of 139 parts TOCCO-hardened by Lima-Hamilton Corp. All show savings over usual heating methods.

Number 7—the lucky number—is up to you. Why not add your name to the list of companies who use TOCCO Induction Heating to increase production, improve products and lower costs. TOCCO engineers are ready to survey your plant for similar cost-saving results—without obligation, of course.

TOCCO

*Trade Mark Reg. U.S. Pat. Off.

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The Tool Engineer

Futures Unlimited

Yesterday's dream becomes today's luxury and then tomorrow's necessity. This has been the theme in our way of life which has been recently termed "Peoples Capitalism." Our continued willingness to increase our productivity and thereby share the good things of life will result in still higher standards of living.

Faith in the future is a prime ingredient in our success story. Proof that business has faith may be found daily in news items: four aluminum producers to invest $935 million in expansion; chemical plant addition, $2 million; new $5 million screw and bolt plant to be constructed; engineering company sets up three branch offices; large manufacturer borrows $250 million for expansion. Businessmen, including the financiers who provide the money, do not spend this kind of money without confidence. Obviously they believe in the future.

Further evidence of confidence is revealed in a recent report from the U. S. Department of Commerce in which it is estimated that the third quarter spending on capital expansion will be about 25 percent greater than the money so invested in the third quarter of 1955.

Tool engineers have good reason to be confident of the future. Business activity cannot be implemented and operated without the tool engineer. He will be needed as never before to help transform materials and labor into serviceable products.

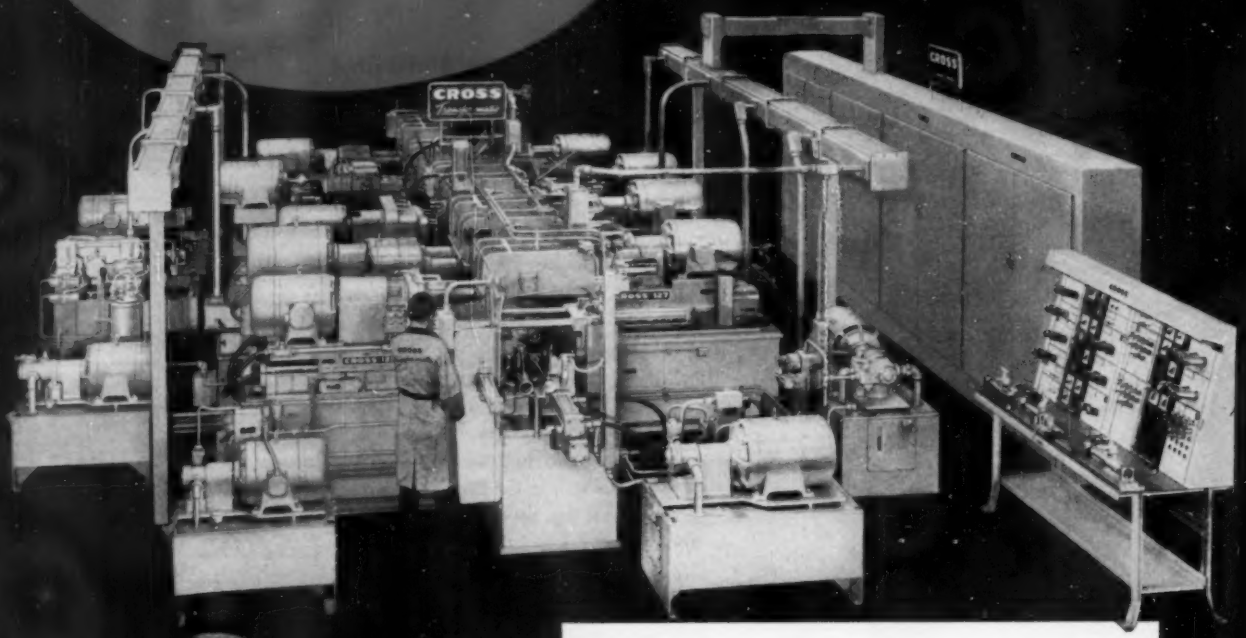
Tool engineers salute industry and business leaders who have confidence to "lay it on the line." We will do our part to help create unlimited futures for all.

H. C. McMillen

President

Bores, Drills Chamfers, and Taps Rear Axle Housings

Another Transfer-matic by Cross



- ★ Rough and finish bores two tube holes; rough and semi-finish bores differential case bearing seats; rough and semi-finishes pinion shaft bore; drills, chamfers and taps ten cover screw holes.
- ★ 75 pieces per hour at 100% efficiency.
- ★ Twenty-two stations: one for loading, one for unloading, four for boring, two for back-boring, two for drilling, one for tapping, one for turn-over and ten for inspection.
- ★ Lift and carry transfer mechanism.
- ★ Cross Modular Unit Construction provides flexibility for part design changes.
- ★ All parts in Cross Machines—even details—are made to interchangeable tolerances for fast, easy maintenance.
- ★ Other features: Construction to JIC standards, hardened and ground ways, hydraulic feed and rapid traverse for boring and drilling, individual lead screw feed for tapping, automatic lubrication.

Established 1898

THE **CROSS** CO.

First in Automation

DETROIT 7, MICHIGAN

Production engineering team discussing ideas for improving manufacturing methods.

applying CREATIVITY to manufacturing problems

By Howard L. Roat*

Director of Production Engineering
AC Spark Plug Div.
General Motors Corp.
Flint, Mich.

Few companies utilize the full creative potential of their personnel, even in such areas as tool engineering where ingenuity is a daily requirement. One of the most successful programs to tap this rich source of improvement to come to the attention of the editors is that unfolding at AC Spark Plug. Much can be learned from their experience.

INDUSTRIAL progress has never permitted settling on a plateau of success and complacency for very long. Now more than ever the increasingly competitive nature of American business makes guaranteed markets a thing of the past. In the automotive field alone many famous companies have disappeared because they stood still creatively while competitors were innovating one idea after another to make cars better and cheaper. With the demand for constantly accelerating progress there is a great need for more creative thinking.

One of the most fertile fields for application of creativity in a modern business is in lowering production costs, by the utilization of less expensive

*Senior member ASTE Flint Chaper

Sample reports from Production Engineering Status book. Each suggestion is classified, given a project number and dated. Follow-up responsibility is assigned to one or more team members.

materials, new processes, better methods and improved tooling. Greater progress in these fields can be achieved by an open-minded attitude and idea stimulation methods such as developed in our creativity program.

Until recently creativity or inventiveness was commonly supposed to be inherited, like blue eyes or red hair, and little or nothing could be done to develop this ability. Even when AC and other firms felt the need for more creativity in solving engineering and manufacturing problems and began investigating the possibility of setting up programs to develop this valuable quality in employees, considerable skepticism was encountered, extending to professional sources such as training specialists and psychologists. The results achieved in manufacturing alone, however, have dispelled all doubts about the success of such a program.

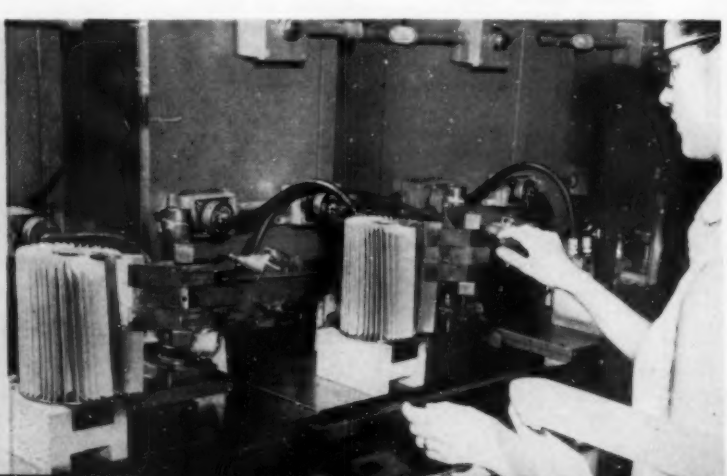
The body of information, principles and procedures which we have integrated into a creativity program have been accumulated and developed from several sources. From case histories of inventors have come their analyses of processes they have undergone in producing successful innovations. The businessman has offered some methods for stimulating productive thinking and psychologists have contributed theories on mental processes of imagination, reason, logic and memory. From this material, as a starting point, has evolved our definition: creativity is the combination of old and new ideas to form a new combination which will satisfy some expressed or implied need.

Setting Up the Program

The first step in our program consisted of setting up a testing plan to measure this ability. It is well known that two people in a given situation will see different things. The creative person will visualize more than is apparent to the noncreative individual. Our objective was to determine the present degree of creative ability of our people in product design, production engineering and manufacturing.

In consultation with a number of eminent psychologists, such as Dr. Thurstone of University of North Carolina, Dr. Burns of University of Chicago and others, Dr. Richard Harris set up for us an impressive battery of aptitude tests for creativity. At the same time, in order to develop materials and methods for training and developing creative abilities, we brought in Professor John Arnold of the Massachusetts Institute of Technology, who is rapidly becoming noted for his work in the field of creativity.

Our training work that resulted has been most productive and we have some interesting test results that clearly show the increase in the ability of a person to produce ideas after he has taken this train-



Translation of ideas into better equipment and processes—as exemplified by this advanced method of applying heat to seal leaves of a new design of oil filter—provides final proof of the pudding.

ing. For instance, a group of thirty-nine automotive engineers was given the test of creative ability both before the training course and after they had taken it. The group had an average of 82 ideas per member prior to the training. After completing the training, this figure stepped up to an average of 116 ideas—a 41 percent improvement.

Even more significant data emerge if the group is divided into high and low categories. Those who had more than 80 ideas on the first test are placed in the high division. Before training the high group had an average of 106 ideas. After training this increased to an average of 133 ideas, a 25 percent improvement. On the other hand the low group had an average of only 60 ideas before training. After training this jumped to an average of 100 ideas, a 67 percent betterment!

Manifestly the training program is of greatest help to those who need it most, since those who have been producing the fewest ideas show the most marked growth in creative ability. We find, however, that practically everyone who takes the training gains substantially in his creative ability.

Placement of Personnel

Our next objective, in order to secure maximum benefit from the program, was to place people with creative ability to their and our best advantage. This meant that as changes were contemplated in our organization, we should endeavor to place those with proper abilities on appropriate jobs.

For example, if an engineer was required for our methods department, we would want a man of high creative ability. The need for this qualification is obvious, since he will be required not only to handle many new ideas of others, but he is also continually called upon to conceive improved ways of manufacturing our products. The assignment, when properly handled, should be to the man's advantage, because he should make rapid progress, and he should likewise contribute greatly to the company's progress.

We soon found as a result of our testing, training, placement and emphasis upon creativity and conception of new ideas, that we had a new problem on our hands. A flood of new ideas was being submitted. However, we were not prepared with an organized approach that would give proper consideration to the many suggestions that were being proposed.

We have nine major manufacturing areas which produce the following products:

1. Spark plugs for automotive and aircraft use
2. Oil filters and gas strainers
3. Decorative die castings
4. Instrument panels
5. Plastics
6. Fuel pumps
7. Air cleaners
8. Flexible shafts and heavy-duty gages
9. Defense products.

Since joining General Motors Corp. in July 1925, Howard Roat has carved a career in tool engineering which exemplifies the American formula for success through hard work and technical ability. Attending the General Motors Institute in Flint he served as a machine tool designer at Buick. Since receiving his degree in Industrial Engineering in 1929 he has progressed through many interesting assignments in the manufacturing field including inspection superintendent, supervisor of employee relations, assistant master mechanic, assistant superintendent of toolrooms, manufacturing superintendent, master mechanic and finally director of production engineering. He has been with AC Spark Plug Div. since 1933.

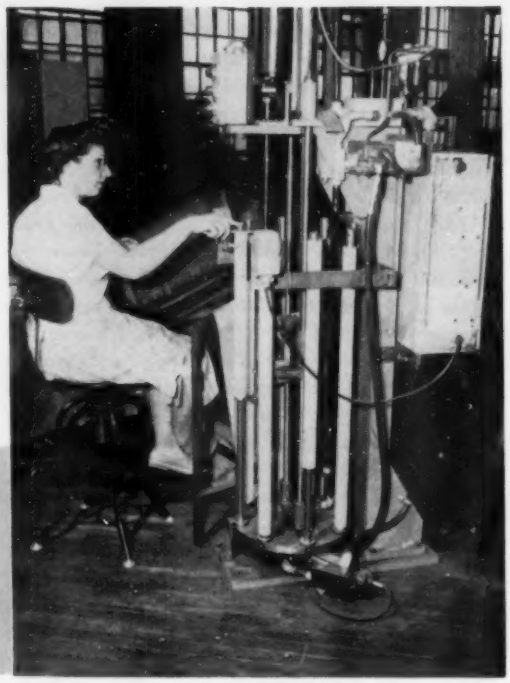
All of these areas have tool engineers, process engineers and methods engineers assigned to properly carry out their various functions. Each classification reported to a different supervisor and naturally each group was trying to place its own ideas into effect.

Team Organization

Our problem was one of being able to properly evaluate ideas and see that the most desirable received first consideration for completion, so that maximum benefits could be secured for the manufacturing areas. We soon found that it was impossible for any one individual to evaluate all ideas or projects.

By evaluation we mean the economic justification of the ideas or projects. Economic justification involves determining potential savings that would be secured from the capital invested. It is based upon such items as rate of return, longevity of the project, time required to complete the facility and the effect it will have upon the product, the manufacturing process and the manufacturing area.

With these problems in mind, we conceived that the most desirable move to make was to form the various engineers that served each manufacturing area into a team. The leader of this team would be the production engineer who had responsibility for establishing the equipment, the processes and the methods for a manufacturing area. The make-up of a team would be as follows: (1) production engineer as the leader; (2) methods engineer to han-



(Above) Old method of assembling gasoline strainer elements involved repetitive operations with high degree of manual dexterity in loading spindles. Rejections were high.

Production engineering team developed simplified method using indexing fixture, preloaded tubes holding disks and semiautomatic pick-off of correct number. Product quality is raised and output increased.

dle methods; (3) process engineer to handle new processes; (4) tool engineer for tooling requirements.

Through various training programs conducted by AC's organization, our engineers have been well trained in our objectives. They now operate as a team, evaluating all ideas in their area and seeing that those with the greatest potential return are given first consideration for completion. This form of organization also makes it possible to give first consideration to projects that management wants placed into operation as soon as possible.

In order to give proper recognition and provide an incentive, together with assistance where required, a continuous follow-up procedure has been instituted for our production engineering teams. This follow-up procedure consists of a brief progress status record of each project from the time of its conception until it is either successfully completed or placed in the unsuccessful group. Monthly progress report meetings are held with each team. They are attended by the superintendent of production engineering, chief engineer of manufacturing development and the director of production engineering.

It is now a matter of record that this type of production engineering organization completed 355 successful projects during the year 1955. The potential savings for a period of one year, after their successful completion, made it possible for our division to meet the cost of our annual improvement factor.

How a Team Functions

Engineers making up a production engineering team handle all the normal problems which confront an industry in the manufacturing of automobile accessories such as ours. They conceive the tools and equipment required for new products and revisions in our present products. They develop new processes required for the new products or revisions in our present products. They plan the methods to be used throughout the manufacturing area. On top of these responsibilities, they handle all current manufacturing problems concerning tools, equipment, processes and methods.

We felt, however, that this was not enough to receive from our engineers if we were to retain our position in this highly competitive field of automobile accessories. It is said by the president of our corporation that "We have to run as fast as we can just to stay where we are." So, we feel that we must have continual improvements in tools, new and better processes and constant progress in methods.

The problem is how to achieve this type of progress. Basically, each production engineering team receives and conceives many ideas and suggestions, in addition to projects originated by management. These new ideas and suggestions are placed in a special "C" group in our system. The team holds meetings for their consideration and evaluation in which they apply all the techniques that they have been taught through the creative training program. We have a principle that there should be several

successful solutions for every problem. These teams, then, apply the creative approach which consists of the following steps:

Orientation, that is, stating the problem
Preparation, or gathering data
Analysis, which consists of breaking down the material into easily handled elements
Hypothesis, meaning piling up of ideas
Incubation, letting up to invite illumination
Synthesis, putting the possibilities together
Verification, judging the resulting ideas.

The step of hypothesis or piling up of alternatives is a vital one in this procedure. We call this type of meeting "brainstorming," a term which is beginning to receive considerable attention in industry these days. In a brainstorming session the team members just let themselves go wild in conceiving ways to solve a problem.

They record these ideas, then take time to let them incubate. Later on they meet again, put the possibilities together and judge the results. By this time they should have several possible solutions which can be evaluated. These evaluated ideas are prepared for review by the team's superiors. Desirable ones become projects and when funds are approved the facilities are built for operation in the manufacturing area.

The technique of brainstorming can be successfully applied to many problems by any group willing to follow the ground rules that no negative thinking or attempt at evaluation is permissible during the session. An example is an actual problem that has been used with a training group and resulted in a practical solution. The problem is how can we increase sales of radiator caps to maintain steady production and employment. We wish to increase the sale of our product by some new approach. Some of the ideas or ways conceived by such groups for doing this are:

1. Improve the appearance
2. Make it easier to remove
3. Make it less expensive
4. Give one free with each $10.00 purchase
5. Put on a sales campaign
6. Put a lock on it
7. Put two on each radiator
8. Design it so that it will tell when the water is low
9. Build a tester to test it at service stations
10. Make it larger
11. Design it so that the radiator can be filled without removing it
12. Design it so the radiator cap fits the gas tank
13. Include a spare with each new car
14. Design it so it can be an exterior part of the car
15. Design cover to indicate pressure
16. Sell in kit along with other accessories.

Evaluation of these ideas in a later session would eliminate many of them as undesirable or impractical. Out of this list, however, came one suggestion that has been adopted by AC. This is number 9, "Build a tester to test it at service stations." Investigation showed that caps for modern pressurized cooling systems often lose their effectiveness after a period of service. This can be demonstrated to car owners by a service station attendant if he has a convenient testing device available. The one designed for this purpose is illustrated in use in an accompanying photo.

Ideas created in brainstorming session, such as radiator pressure cap tester, can be an important factor in success of a business.

While manufacturing problems are usually more complex, the example does offer a graphic demonstration of how creative techniques can be organized and utilized in business. The emphasis being placed on creativity is having an effect in all areas of our national economy, even in our educational systems. Definite progress is being made in industry to tap the great creative potential of employees.

In order to accept the ideas and suggestions of people with creative potential, it is necessary that we gear our organizations to fit changing conditions. New approaches in handling and supervising creative personnel must be conceived and placed in operation in order to encourage and properly utilize the creative ability of such individuals. As a corollary, it is essential that economic justification of industrial improvements be studied and carefully evaluated before major expenditures are made.

We feel most strongly that this type of thinking and this approach is one of the major factors in promoting for our nation the highest standard of living in the world.

Gadgets

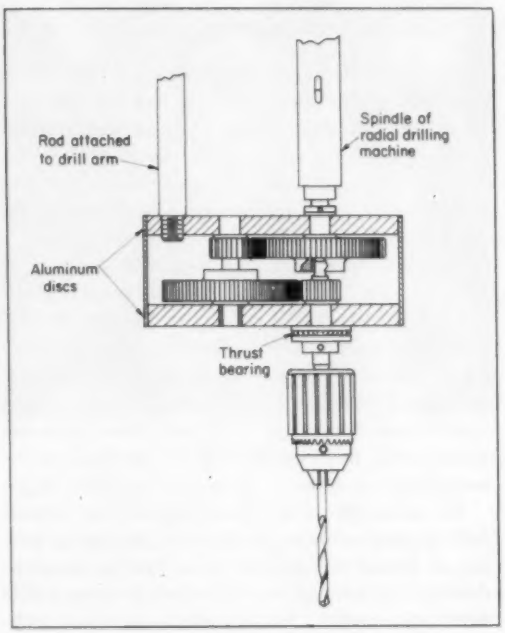
Ingenious Devices And Ideas To Help
The Tool Engineer In His Daily Work

High-Speed Drive for Drills

Occasionally it is necessary or desirable to drill small holes using a large radial drilling machine. The workpiece may be too large to be accommodated in a small drill press, or it may already be set up in a large machine. In such cases, drilling efficiency is reduced because of the comparatively slow spindle speeds of large machines.

The geared head illustrated is used to increase drilling speeds substantially under the conditions described. Two aluminum plates held together with four tie rods, not shown, comprise the body of the device. A rod attached to the top plate is fastened to the arm of the radial drill to keep the gear unit from rotating. The driving shaft of the unit is tapered to fit the radial drill spindle and carries a gear, keyed to the lower end. This gear drives an intermediate shaft to which two gears are keyed. A fourth gear powers a driven shaft which carries a chuck. The upper end of the driven shaft is machined to run in a bushing pressed into the bottom of the driving shaft, keeping driving and driven shafts in alignment. All shafts ride in bronze bushings.

In service, the unit is light and easy to set up, and provides a wide variety of spindle speeds in a range well above radial drill spindle speeds. Because the spindle of the unit is in line with the main spindle, it can be conveniently used for centering or spotting before drilling large diameter holes.



Ernest Jones
Bronx, N. Y.

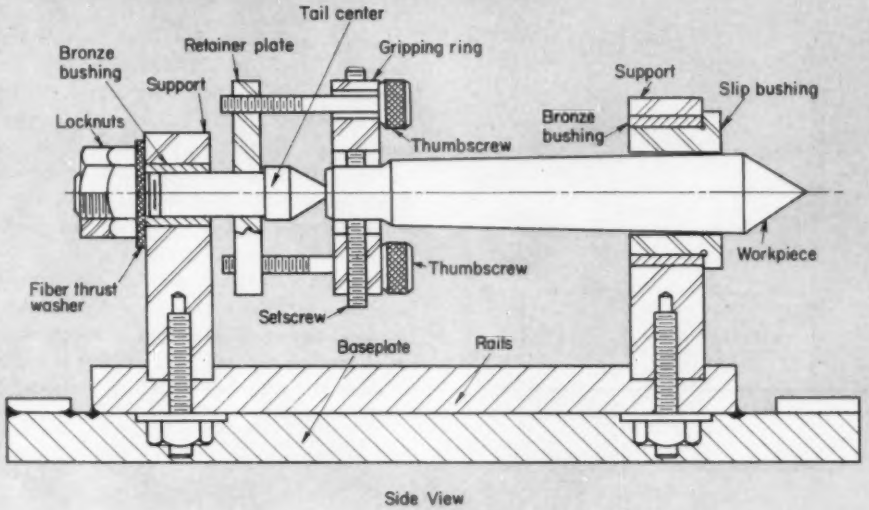
Center Grinding Fixture

Regrinding of lathe and grinder centers is often accomplished directly on the machine tool on which they are used. This may take a badly needed machine out of production for some time. On the other hand, stocking a full set of accurate sleeves to allow the job to be done on a tool and cutter grinder is expensive and often cannot be justified for occasional use.

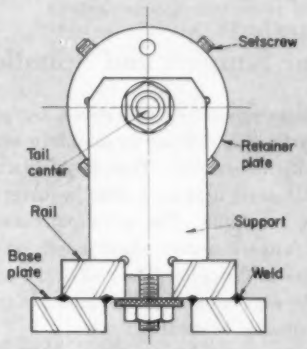
The center grinding fixture illustrated can be used on any available tool and cutter or cylindrical grinding machine. It was designed to hold a wide variety of tapered centers for purposes of point regrinding and does not require tapered adapter sleeves as is commonly the case with work-head center grinding methods.

The fixture consists of front and rear workpiece supports which slide on a track to accommodate workpieces of various lengths. A stud, washer and nut arrangement secures the supports to the track. Holes in the supports are bored together to insure alignment and both holes are fitted wtih bronze bushings. A hardened and ground slip renewable bushing fits into the bronze bushing in the front support. The large end of the workpiece is supported by line contact on the front edge of the ID of the renewable bushing. This provides sufficient seating for the light grinding pressures involved.

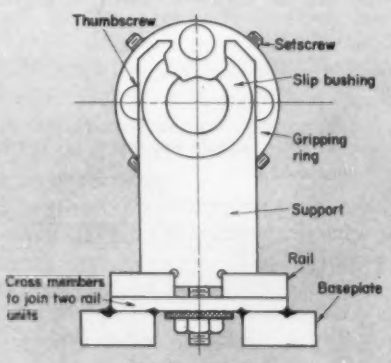
A hardened and ground tailstock supports the small end of the workpiece. The tailstock fits into a bronze bushing, and is secured for end thrust by



Side View



View from Left End



View from Right End

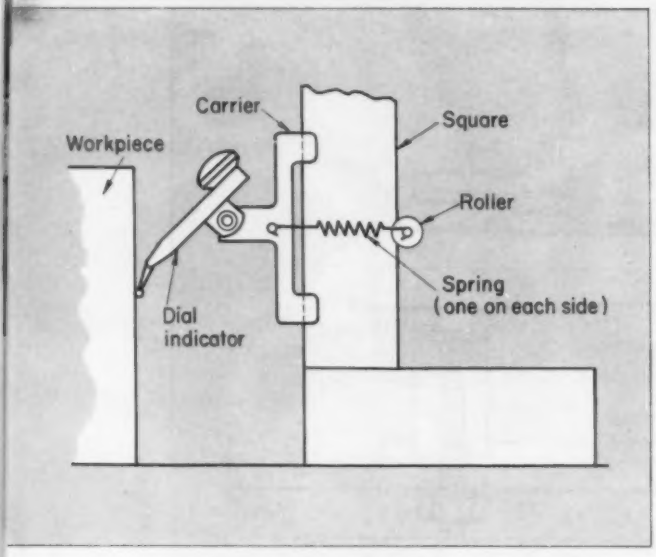
lock nuts seated against a fiber thrust washer. Setscrews in a gripping ring attached to a retainer plate by thumbscrews securely lock the workpiece against the tail center and assure a tight fit of the large end of the workpiece in the bushing in the front support.

A few drops of lubricating oil placed on moving parts at the time of setup provide sufficient lubrication for the short work time involved. Rotation of the workpiece is manual. When changing from one type of taper to another, the slip bushing in the front support is changed to one of the correct diameter. Adjustment for length is accomplished by moving either of the two supports.

The fixture may be used on any cutter grinding machine. In use, it is bolted or clamped to the machine table. The table is swivelled to a 30-degree angle for traverse grinding of a 60-degree point. An alternative method is to swivel the table to a 30-degree angle and form the point by plunge cutting with a wide face wheel.

H. J. Gerber
Member at Large
Stillwater, Okla.

Gadgets



Traversing Indicator for Vertical Edges

Layout and inspection work can be expedited through the use of a relatively simple device designed to carry an indicator along a vertical edge. The device consists of a square and a carrier for the indicator as illustrated. The body of the carrier is machined from bronze and is held to the square by means of a roller and two springs. The springs should be tight enough to prevent the carrier from sliding down under its own weight.

To check an edge to see if it is square with the base, the carrier is moved up and down the square. No great degree of precision is required in fabricating the carrier and its accuracy is not affected by wear of the surface on which it slides.

H. Koslow
Bronx, N. Y.

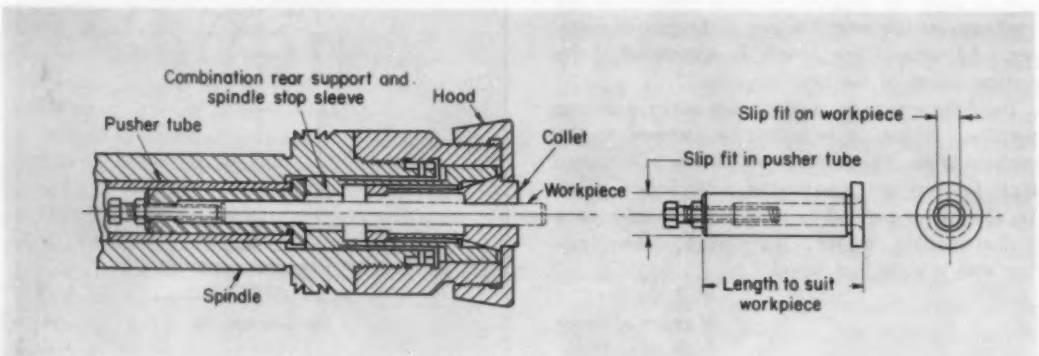
Combination Rear Support and Spindle Stop

Often when secondary operations are performed on long parts, it is difficult to maintain satisfactory concentricity tolerances. This is particularly true of small-OD parts held by collets in turret lathes or hand screw machines. The principal cause of runout is the proportionately short length of the holding diameter of the collet. The end of the part inside the spindle sags when being clamped and whips when the spindle is rotating.

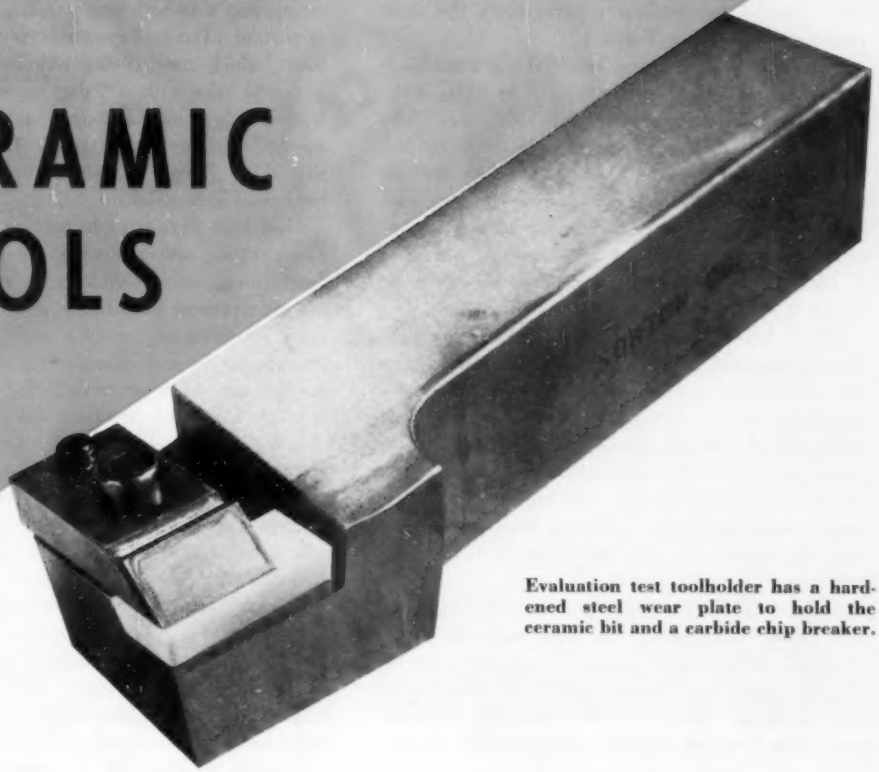
The combination rear support and spindle stop illustrated eliminates most of the sag, holding the inner end of the part nearly in line with the spindle center line. In one instance, runout on a production part ran from 0.005 inch to 0.008 inch total indicator reading when using a standard collet. With the rear support inserted behind the collet sleeve this runout was reduced to less than 0.001 inch. A reamed hole machined in this setup was maintained well within a specified 0.003-inch total indicator reading for concentricity with the OD throughout a production run of 1000 pieces. This was not possible prior to development of the rear support. Part length was six inches with a half-inch OD.

The adjustable stop screw facilitates positioning parts from the spindle end while using the rear support, and can thus be used as a spindle stop.

W. R. Eldridge
Little Rhody Chapter



production results with CERAMIC TOOLS



Evaluation test toolholder has a hardened steel wear plate to hold the ceramic bit and a carbide chip breaker.

By

W. M. Wheildon

Senior Research Engineer

and

G. W. Barnes

Sales Engineer
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Field evaluation tests of ceramic cutting tools were started in late 1955 by Norton and definitely pointed toward the successful use of ceramics in metal cutting. The authors first presented the results of the field tests at the 1956 Purdue Tool Engineers Conference.

WITH RUMORS RAMPANT about European use of ceramic cutting tools in metalworking and because of the high interest stimulated by work done at the Watertown Arsenal, a field evaluation program was started to determine ceramic tool potentials. Production personnel were contacted who could provide evaluation data based on work done under production conditions. Ceramic tool blanks were supplied to the companies with the recommendation that they be used in toolholders of the type developed at Watertown.

Industry acceptance of this program was enthusiastic and over 250 separate evaluation test locations were established within a few months. Initial reports from cooperating companies told of successful turning of a number of materials at speeds far beyond those used with tungsten carbide. Superior finish, excellent size control over long workpieces and good tool life were other

benefits reported. Built-up edge and cratering, which have long plagued tool engineers working with carbides, do not occur with aluminum oxide tools. Test engineers were quick to notice, however, that chatter and vibration limit ceramic tool life much more than they do tungsten carbide tool life. One of the earliest reports from the field program is shown in TABLE 1.

Favorable reports were received on machining carbon steels, and alloy steels such as 4140, 4340 and 8620 with hardnesses up to 300 Bhn. The reported cuts ranged in depth from 0.005 to 5/16 inch; in speed from 160 to 1400 sfpm and in feed from 0.005 to 0.021 ipr. Heavier cuts and feeds, and higher speeds were not attempted because machines were used at maximum capacity. A resume of a few of the reports is shown in TABLE 2.

All of these reports are based on work done on regular production parts. The test engineers were enthusiastic in their comments. They were undoubtedly evaluating the ceramics in terms of carbide tool performance under conditions that may prove normal for ceramics although they are abnormal for carbides. One test engineer, for example, purposefully tried to break the ceramic tool when he varied his feed rate between 0.010 and 0.060 ipr.

As part of the field test program, limited tests were made on finishing cast iron and cast steel. Results were favorable but more work is necessary before accurate conclusions can be drawn. Steels with hardness values over 300 Bhn and stainless steels have been cut with promising results. Again, more work will have to be done before machining of such high-alloy steels will be practical with ceramic tools.

Tool geometry and toolholder design are of paramount importance. A rigid shank and a clamping device that grips the bit firmly between a broad clamp and a smooth seat parallel to the clamp are important. The tool geometry developed at Watertown, which uses 10-deg clearance angles, an 8-deg side rake with a 7-deg negative land on the leading edge, and a 0-deg back rake, has been successful in our test program. Throw-away blanks with 5 or 7-deg double negative rakes have also been used with good results.

Most tests were straight turning and facing cuts. Form cutting, tracer turning, plunge cutting, shoulder turning, interrupted cutting, milling and shaping all represent potential applications for ceramic tools. Preliminary results with tracer turning, plunge cutting and shoulder turning indicate that development of ceramic tools for such production techniques will be practical after further study.

Based on present tests, the future of ceramic tools appears promising. Improvements will certainly occur in the tool bit materials and in the machines on which the bits will be used. Machines will have increased rigidity, increased speed, increased horsepower and better chip protection. Automatic controls will probably become important because operator control is difficult at high speeds. Tool bit compositions will be improved to make the tool less fragile. We feel that ceramic chip breakers will replace tungsten carbide to avoid chip breaker cratering which has been encountered.

Ceramic tooling will be accepted because the tool materials are in abundant, nonstrategic supply and because, when used under optimum conditions, ceramics can operate at higher cutting speeds than have previously been practical. Many machines in industry today can successfully use present ceramics at speeds much greater than those now used with carbide tools. It is difficult to anticipate the results that will be achieved when equipment has been designed specifically to get the most out of ceramic cutting tools. We can only hazard the guess that the results will be far superior to anything possible in industry today.

Table 1—Comparative Gear Blank Machining Results

Characteristic	Ceramic	Tungsten Carbide
Cutting speed (sfpm)	850	350
Depth of Cut		
Roughing (inch)	0.140	0.140
Finishing (inch)	0.015	0.015
Feed Rate		
Roughing (inch)	0.020	0.030
Finishing (inch)	0.015	0.015
Finish (microinches, rms)	120	150
Tool Life (minutes)	90	25
Floor-to-Floor Time Saving (%)	20	—

Note: Workpieces were AISI 4620 steel forgings with 29-inch OD and length of 15 inches.

Table 2—Typical Field Reports on Ceramic Tools

Test Company (No.)	Production Workpiece Material	Hardness Value (Bhn)	Type of Cut	Cutting Speed (sfpm)	Feed Rate (ipr)	Depth of Cut (inch)	Chip Removed Before Regrind (feet)
1	AISI 1020	—	facing	193 to 1410	0.010	0.100 to 0.187	807*
2	AISI 1045	240	turning	1185	0.013	0.032 to 0.094	27,000
3	AISI 1040	220	turning	1350	0.015	0.040 to 0.060	71,000
4	AISI 4340	280	turning	400	0.010 to 0.060	0.010 to 0.100	37,000
5	AISI 4140	—	turning	690	0.012 to 0.0165	0.030	21,000
6	AISI 1040	—	facing	1150 to 880	0.015	0.250 to 0.312	24,000

* *Chip removed in cubic inches.*

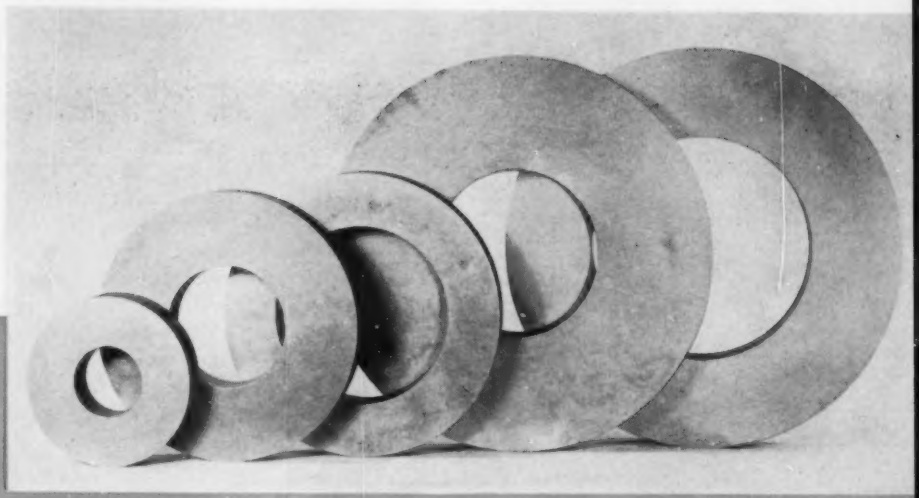

Fig. 1. Typical steel rings used during test. Use of various sizes of rings made it possible to evaluate the effect of mass on size changes.

size changes of steel rings during heat treatment

By C. P. McShane and R. W. Bratt

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Will a tool steel ring die expand or contract when quenched? When quenched and tempered? How will the size changes vary with different types of tool steel? The authors, in a series of experiments, obtained some of the answers to these fundamental questions. The data obtained is of practical value to tool engineers.

WHEN STEEL IS HEATED, it expands, and when it cools, it contracts. This property has many industrial applications, one of the most common being the locking of mating parts together by means of a shrink fit. When steel is heated above temperatures at which actual internal structural changes or transformations occur, however, the direction and magnitude of the resulting size changes are difficult to predict. Many factors, including the type of steel, size and shape of the test piece and methods of heat treating and cooling employed, influence the ultimate size of the piece.

A series of experiments was carried out to evaluate the effects of heat treatment on the size of tool-steel rings, *Fig.* 1. The rings were cut from AISI-SAE W1, O1 and D2 type hollow tool steel bars. To determine the effect of mass on the size changes observed, several ring sizes of each type of tool steel were used. The nominal sizes and analyses of the rings are given in TABLE 1. Flat surfaces were ground and outside and inside diameters were

Table 1—Nominal Sizes and Analyses of Tool Steel Rings

AISI-SAE Designation	Nominal Sizes			
	OD (inches)	ID (inches)	Wall Thickness (inches)	Ring Thickness (inches)
W-1 Typical analysis: C Mn Si 1.00 0.25 0.20	5	2	1½	1
	8	3½	2¼	1
	8½	5¼	1⅝	½
	8½	5¼	1⅝	1
	8½	5¼	1⅝	2½
	12	5	3½	1
	12	7	2½	1
O-1 Typical analysis: C Mn Cr W 0.90 1.30 0.50 0.50	4	2	1	1
	8	3½	2¼	1
	8½	5¼	1⅝	½
	8½	5¼	1⅝	1
	8½	5¼	1⅝	2½
	12	5	3½	1
	12	7	2½	1
D-2 Typical analysis: C Cr Mo V 1.50 11.50 0.80 0.20	4	2	1	1
	8¼	3½	2¾	1
	8½	5¼	1⅝	½
	8½	5¼	1⅝	1
	8½	5¼	1⅝	2½
	11	7	2	1
	12	5	3½	1

machined smooth. OD, ID and thickness measurements were all taken at two positions 90 deg apart. Thickness measurements were taken near the OD edges. Measurements were taken after quenching and also after each temper.

Heat Treatment: In the tests, the rings were given a standard hardening treatment and then tempered at successively higher temperatures to note the effect of tempering on size. The W1 rings were packed in new cast-iron chips in a horizontal position and heated slowly to 1450 F. They were soaked 20 minutes at this temperature and water quenched in a vertical position. Following quenching, the rings were tempered two hours at temperatures ranging from 300 to 800 F in 100-deg increments.

The O1 rings, except for the two largest sizes, were heat treated in a horizontal position in a salt bath. Heat treating and quenching of the two largest rings were also accomplished in a salt bath, with the rings in a vertical position. All of these rings were preheated at 1225 F and soaked 25 minutes at 1450 F. They were then quenched to approximately 400 F in agitated oil and tempered 2 hours at temperatures from 400 to 800 F at 100-deg intervals.

A salt bath was used to heat treat the D2 rings, with all rings except the two largest sizes being heat treated and cooled in a horizontal position. The rings were preheated at 1450 F, soaked 30 minutes at 1825 F and air cooled. These rings were tempered two hours at temperatures ranging from 500 to 1300 F. Hardness values for all rings were checked after each temper and are given in TABLE 2.

Test Results: Results of the test showed, as expected, that size changes of tool steel rings undergoing heat treatment do not follow a regular pattern, but vary according to the type of steel, tempering temperatures and other factors. For the water hardening W1 tool steel rings, size changes during heat treatment depend on the size of the section hardened. All dimensions of 1 and 2½-inch-thick water-hardening rings, which do not harden through, may be expected to decrease 0.0005 to 0.0010 inch per inch after water quenching and decrease still further after tempering. If the section is thin enough to allow through hardening, or hardening which is nearly through, these figures are not applicable.

Dimensions of the oil hardening O1 rings increase 0.0010 to 0.0015 inch per inch after oil quenching. Tempering at 400 F causes slight decreases in all of the as-quenched dimensions. Tempering further at 500 F results in increases in all dimensions, ranging from 0.0006 to 0.0010 inch per inch. Tempering above 500 F tends to bring the rings back to their original size.

The air hardening D2 rings expand 0.0002 to 0.0004 inch per inch in all dimensions after air cooling from the austenitizing temperature. Slight decreases in all of the as-quenched dimensions result from tempering at temperatures up to 900 F.

Table 2—Hardness of Tool Steel Rings

AISI-SAE Designation	Tempering Temperature (F)	Hardness (R_C)
W 1	Annealed	159/174 (Brinell)
	As quenched	65/66
	300	64/65
	400	60/61
	500	57/58.5
	600	51/54
	700	48/49
	800	43/45
O 1	Annealed	192/217 (Brinell)
	As quenched	63/64
	400	59.5/60.5
	500	58/59
	600	56/57
	700	52/53
	800	49/50
D 2	Annealed	212/235 (Brinell)
	As quenched	63/64
	500	58/59
	600	57/58
	700	57/58
	800	57/58
	900	57/58
	1000	56.5/57.5
	1100	47/52
	1200	38/39
	1300	31/32

The rings may actually shrink below their original sizes. Tempering between 900 and 1100 F causes increases in all dimensions, ranging from 0.0012 to 0.0014 inch per inch. Tempering above 1100 F tends to bring the rings back to their original sizes.

The size change results for each grade appear to be independent of the ring dimensions for the range of sizes investigated. That is, the size changes of the rings for each particular grade follow the same general pattern and are of about the same magnitude. The one exception is the ½-inch-thick W1 ring which hardened nearly all the way through. None of the 1 and 2½-inch-thick rings hardened through and all showed decreases in all dimensions as quenched, while the OD of the ½-inch-thick ring expanded as quenched.

The average size changes of the rings during heat treatment are shown in *Figs.* 2, 3 and 4. These results are shown in inches per inch and are based on the original OD and ID of the rings.

Causes of Size Changes: There are several causes of dimensional changes during heat treatment. First, of course, is the normal expansion and contraction of steel when heated and cooled. In addition to this, when hardening transformations occur, size changes take place because of the different densities of the transformation products. At hardening temperature, steel is composed primarily of austenite, which is denser than any of its transformation products. After hardening, steel is composed primarily of martensite, which is the least dense of the transformation products. In the annealed condition, ferrite plus carbide, the density of steel lies between that of austenite and martensite.

When a tool is quenched from the hardening temperature, it contracts as it cools and actually occupies less volume just before the hardening transformation begins, about 400 F for a one percent carbon steel, than it will after the hardening transformation is completed. Assuming that appreciable amounts of austenite are not retained, a hardened tool will occupy more volume than a tool in the annealed condition. When a hardened tool is tempered, the density of the steel increases because of decomposition of the martensite, and the tool shrinks.

When a piece of steel is austenitized and quenched so that practically all of the austenite transforms to martensite, an over-all expansion occurs, as noted for the O1 and D2 rings. If no austenite is retained, the steel will shrink as it is tempered at successively higher temperatures. If some austenite is retained, the steel will shrink as it is tempered at successively higher temperatures until that temperature is reached which will condition the retained austenite and cause it to transform to martensite upon cool-

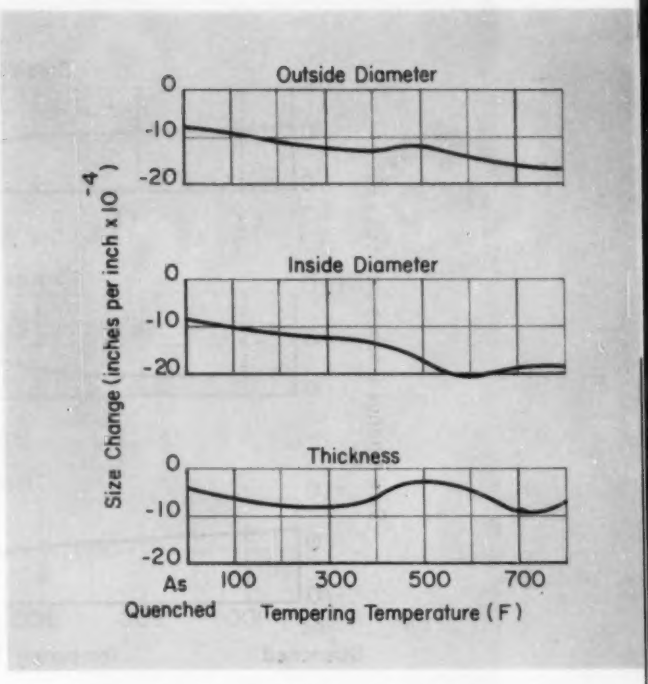

Fig. 2. Average size change of W1 type tool steel rings during heat treatment. One half inch thick ring not included.

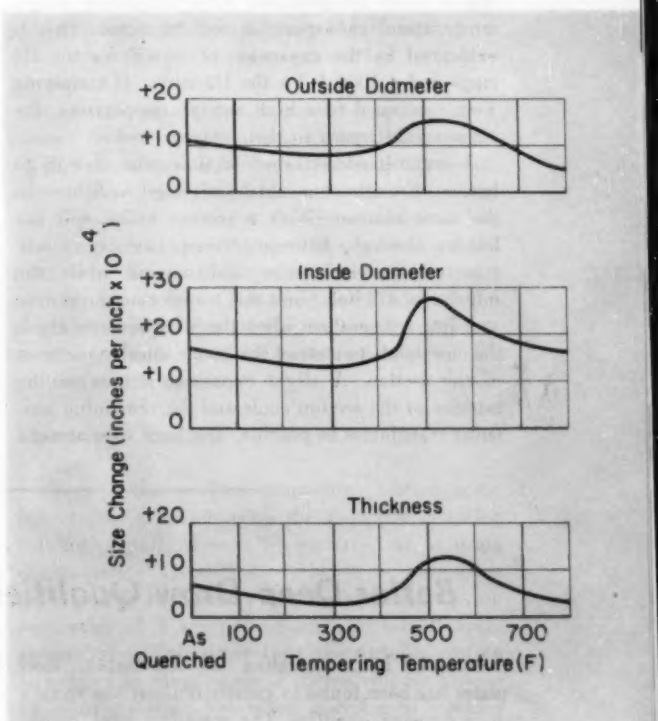

Fig. 3. Average size change of O1 type tool steel rings during heat treatment.

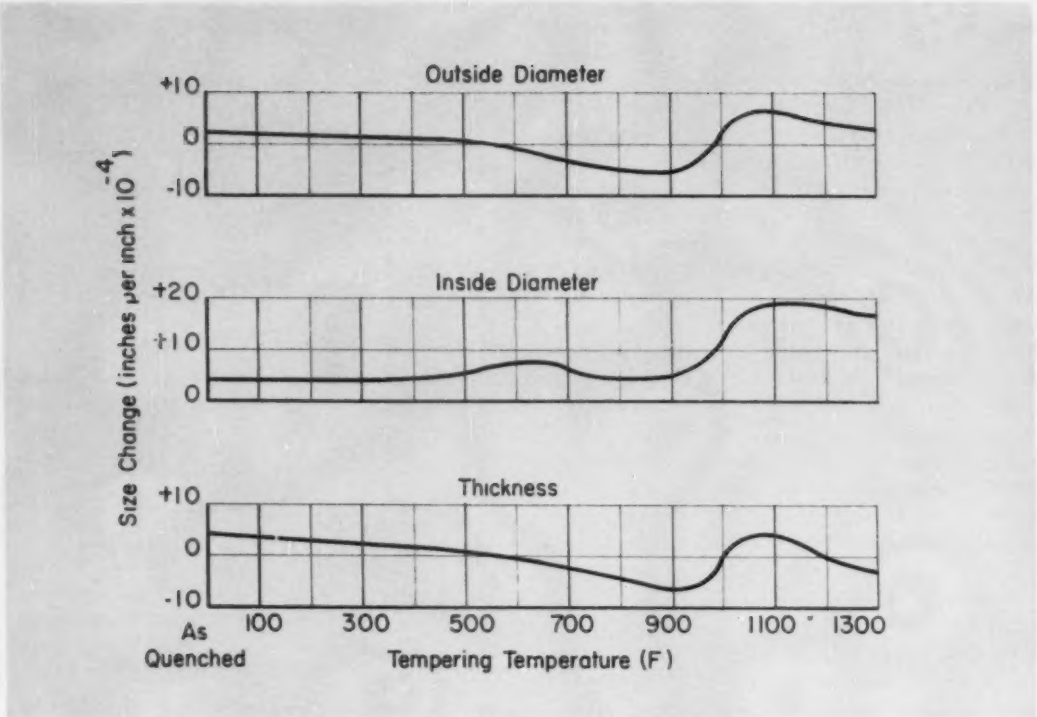

Fig. 4. Average size change of D2 type tool steel rings during heat treatment.

ing to room temperature. After tempering at this temperature, an expansion will be noted. This is evidenced by the expansion at 500 F for the O1 rings and a 1000 F for the D2 rings. If tempering were continued to a high enough temperature, the rings would return to their original sizes.

A water-hardened steel section thin enough to harden throughout would be expected to behave in the same manner. With a section which will not harden through, however, the surface layers will transform to martensite and expand while the interior is still hot. Since this transformation occurs at a low temperature when the steel is quite rigid. the case tends to restrict the hotter interior portions of the section. A slight expansion occurs as the interior of the section cools and the remaining austenite transforms to pearlite. The hard case already formed will tend to resist this expansion. The transformation products then contract as the steel cools to room temperature. Dimensional changes may then occur, depending on the size of section, hardenability and heat treatment of the steel. Expansion, contraction or even no size change can result.

Although distortion has not been discussed, it should be noted that nonuniform temperature gradients during quenching can produce distortion which may confuse the size change picture. The more drastic the quench, the more likely this is to happen. The most significant fact brought out by this investigation is that during heat treatment both the OD and ID of tool-steel rings will move in the same direction and about the same amount as for a piece cut from a solid bar of the same size and grade.

Better Deep Draw Qualities from Blast Descaled Plate

Automatic blast descaling of low-carbon steel plates has been found to greatly improve the metal's deep drawing qualities. The scale-free steel, resulting from this method of prior cleaning, improves die life as does the matte finish which the descaling operations leave on the plate. At Wheelabrator Corp. in Mishawaka, Ind., this surface has been found to have superior lubricating qualities for drawing as compared to those of pickled and oiled stock ordinarily used.

Automatic Position Controls

- increase machine accuracy
- broaden automatic operation
- speed product inspection

By D. A. Korman
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New York, N. Y.

WITH MODERN REQUIREMENTS for high machining speeds and ever-increasing need for accuracy, manual control of machine tools is rapidly becoming impossible. Simple control problems have been solved through application of cam sequencing, precision limit switches and timing devices. As control problems increase in complexity, successful solutions require more positive programming. Although there are several approaches to programming machine movements and different types of equipment to implement specific approaches, discussion of the application and design of one type of positioning controls will indicate the current state of the art.

Some precision control systems can only be applied to machine tools as original equipment. Others, such as this system, can also be adapted to existing machines for more automatic operation. higher accuracy or both. For example, an old milling machine, *Fig.* 1, has been converted into a precision boring machine on which locations of same size holes can be programmed for automatic production.

Position controls can be used to convert drill presses to boring operations, boring machines to jig borer accuracy, grinding machines to automatic size machines and lathes to automatic operation. The type of power drive for the machine is immaterial and the speed of operation is not normally limited by the control system. It is usually convenient, however, to use the magnitude of the position error to control the speed of movement so that traversing will be rapid and approach to position will be slow.

Equipment Design

Heart of this position controlling system is an Inductosyn, a device using the inductive coupling between a pair of metallic patterns for accurate determination of position. Inductosyns have been developed in both rotary and linear forms, having accuracies of 5 seconds of arc and 0.0001 inch, respectively. With either type, the metallic pattern is secured to glass plates. Patterns can be formed on other materials hut, when planning to machine steel, a glass plate with coefficient of expansion equivalent to steel saves calculation of temperature correction, although calculation is not difficult.

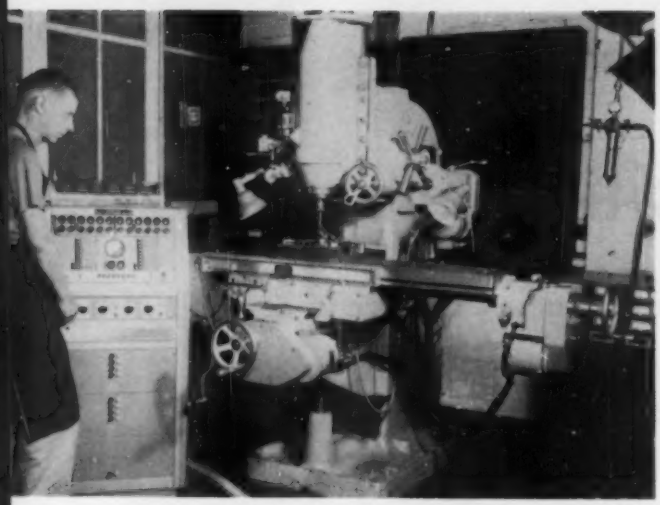


Fig. 1. Milling machine converted to automatic programming for precision boring and reaming operations.

The rotary control is similar to a standard synchro or resolver. The physical quantity that varies as a function of mechanical motion is the electromagnetic coupling, or transformer effect, between the two conductor configurations, *Fig.* 2.

These units usually have a higher number of poles than standard synchros. Output voltage of a 108-pole control, for example, goes through 54 cycles of magnitude variation in one revolution of the input shaft. Stators of the rotary units are divided into sectors. Successive sectors are out of phase by one-half pole, one-quarter cycle. Alternate sectors are connected in series to form the two circuits needed.

Typical error curves of these position controls approximate sinusoidal shapes with a half-amplitude of about 5 seconds of arc. It is also significant that the location of the null position is not dependent on the voltage but on the voltage ratios in the two stator circuits. Angular positions can be achieved in terms of resistance ratios.

Linear controls have precisely spaced metallic conductors on glass plates. One plate is attached to a stationary part of a machine and the other is attached to a moving part. Air space between the two plates is 0.005-0.015 inch. The electronic scale, *Fig.* 3, corresponds to the rotor of the rotary type and consists of a single hairpin winding. Two space-phase windings on the linear electronic slider correspond to the stator of the rotary type. Since these controls operate on single-phase alternating current, references to phase are to space-phase rather than time-phase. Relationships between the various windings are shown in *Fig.* 4.

Since scales and sliders are attached directly to machine parts, indication of position is not dependent on mechanical components. Also, since measurements are always referenced to an established zero point, accumulated errors are avoided. Zero for the system can be established at any position on the machine to suit requirements.

An important feature of these controls is that the error signals from all pairs of poles are averaged so that any noncumulative errors in pole spacing are minimized. A number of linear scales can be placed end-to-end to form any length of scale from 10 inches to thousands of inches. For long distances, two sliders can be used with an appropriate switching circuit arranged to select the correct slider and scale elements for the position desired. Because of the averaging effect of the slider, there is no discontinuity in passing from one scale element to the next.

Correct position of the slider with respect to the scale, i.e., positioning the machine member, is established by reducing the error voltage to zero. The error voltage increases on either side of the null with opposite phase. Thus, the position of the null can be shifted by an extraneous voltage. Deliberate introduction of an extraneous voltage provides an effective means of shifting the position of the null and, if the magnitude of the extraneous voltage varies with position, it has the effect of changing the effective length of the scale. Temperature compensation, when machining materials with different coefficients of expansion than the glass plates, can be introduced by this technique.

When set up for automatic operation, input voltages corresponding to the desired position are provided by precision voltage dividers, actuated by pushbutton rotary switches, *Fig.* 5, punches cards, tapes, etc. A conventional servo drives the machine member (and the slider or scale) until the error signal from the control element has reached a null.

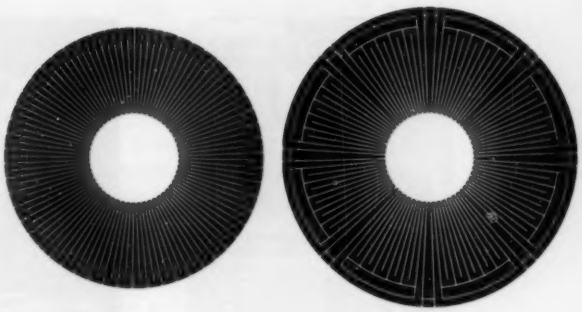
Since there is a plurality of points, each of which provides a null voltage, a coarse data element must be used. This element can be a potentiometer or synchro driven by an appropriate rack and pinion or leadscrew. Inasmuch as the Inductosyn can control motion within a scale cycle (0.1 inch), the coarse system is necessary to position the slider within less than 0.1 inch. The coarse voltage divider sets up linear voltage corresponding to the desired position. The error of this coarse position controls the drive until the moving member is within 0.02 inch of its correct position. Fine error voltage is then substituted by actuation of an electronic switch, at which time the Inductosyn takes control.

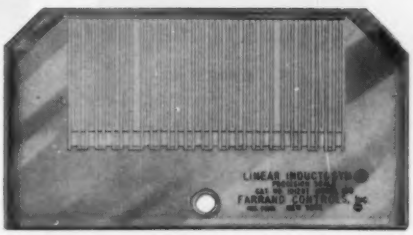
Because of the electrical identity between resolvers and Inductosyns, a convenient method for setting up position signals is to connect the two phase-windings of a commercial resolver to the linear slider. Each revolution of the resolver will then cause the moving member to progress 0.1

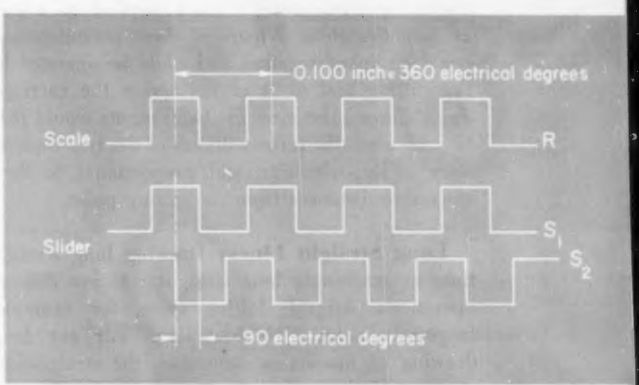
Fig. 2. (right) Rotor and stator of a rotary Inductosyn show the metallic patterns secured to glass plates.

Fig. 3. (center) Linear sliders and scales are identical in circuit structure to the rotary models but have infinite-radius plates.

Fig. 4. (lower right) Relationships of the slider and scale windings in a linear control. The two windings of the slider are spaced 90 electrical degrees apart.







inch. With a dial on the resolver shaft divided into 100 parts and a vernier, machine member movement can be controlled in steps of 0.0001 inch.

Associated Equipment: Electronic auxiliaries required to form control systems with these linear and rotary controls are designed into complete, matching units. A typical system would need about eight such units. A majority of the units use two miniature, ruggedized, removable tubes. Other components of each electronic package are encapsulated in plastic to give strength and insure operation.

Two stator amplifiers are used to couple a 10-kc resolver to the rotary Inductosyn. A detector-amplifier functions to convert the 10-kc error signal of the error amplifier to an appropriate d-c current suitable for driving a conventional saturable reactor, amplidyne, hydraulic servo valve, etc.

An oscillator unit provides the 10-kc operating voltage of the Inductosyn. Each system uses an oscillator to supply the Inductosyn as well as a reference voltage for the operation of the detector-amplifier. An error amplifier functions to amplify the rotor voltages. Operating at 10 kc, the amplifier output is coupled to the detector-amplifier.

An electronic switch is used to transfer from coarse to fine control in an automatic servo system. An additional unit, not always required, is a twin amplifier used for gain in coarse and medium data circuits.

Control Applications

In addition to various test setups, a typical installation of this automatic position control system has been made on an old milling machine, *Figs.* 1 and 6. This machine has been converted for precision boring operations. Linear scales and a slider are mounted along the table and cross slide.

Work performed on this machine consists of automatic sequential operations comprising boring and reaming of precisely located holes. While the inherent accuracy of the control is 0.0001 inch, accuracy of this machine is limited by the stability of the carriage, slides, etc., and the precision of the ways. In this application to an obsolete machine, an over-all accuracy of 0.0005 inch (center-to-center) has resulted.

Phantom Electronic Scale: When a carriage, such as that of a machine tool, is carried on a pair of ways and when a linear positioning scale is at-

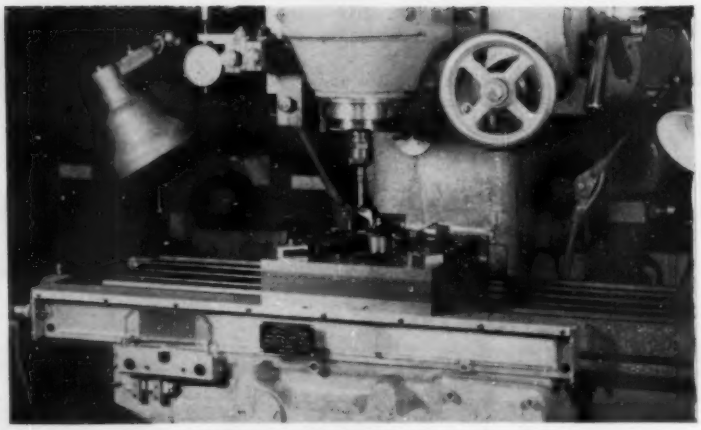


Fig. 5. (left) Although this is a typical control unit, control consoles can take any form. Programs can be set up by cards, tapes or drums, or manually by pushbutton switches.

Fig. 6. (above) Location of this boring tool is precise through accurate control of the table on which the workpiece is mounted.

tached on one side of the carriage, carriage cocking can introduce errors. Since the cutting tool would not normally be near the scale, its movement would not be accurately controlled. Although this error is not large in a well-constructed machine, it cannot be ignored in precision work.

This error can be corrected through use of a phantom scale, *Fig.* 7. Positioning scales and sliders can be mounted on both sides of the carriage and their respective error voltages applied to a pair of potentiometers. Wipers of these potentiometers could be linked together and could be operated by the cutting tool as it moves across the carriage. The difference between the two outputs would then be zero when the error voltages of the two controls were of opposite sign and proportional to their respective distances from the cutting point.

Long Straight Lines: Drawing long straight lines or machining long straight cuts are difficult operations. Aircraft lofting grids, for example, frequently require 100-foot lines. For any long drawing or machining operation, the straightness of the result depends on the straightness of the ways upon which the operating carriage moves.

A linear position control, in combination with optical tooling equipment, *Fig.* 8, provides a means for producing accurate grids of any length. The grid scribing point is attached to the slider and the scale is fastened to the carriage through a leadscrew and servo drive. An illuminated target on an extension of the scale projects into the line of sight of an alignment telescope whose optical axis is set parallel to the lines to be drawn.

The image of the target in the telescope falls upon a slit behind which is a phototube. As the target deviates from the line of sight, it is vignetted by the slit and the phototube produces an error signal. This signal operates the servo drive to adjust the position of the scale on the carriage so the target is maintained exactly in the line of sight. The same techniques can be used to guide machine tools over long, straight cuts.

Cutter Radius Computer: One of the important features of this type of machine tool control is the provision for cutter radius correction that it provides. Input to the control consists of data concerning the shape of the part to be machined. Allowance for the radius of the cutter is introduced at the machine by the operator.

In this way, various tools can be used at the discretion of the operator and the tools may be reground without disturbing the input program. This is important because, if the tool radius had to be incorporated in the input data, calculation

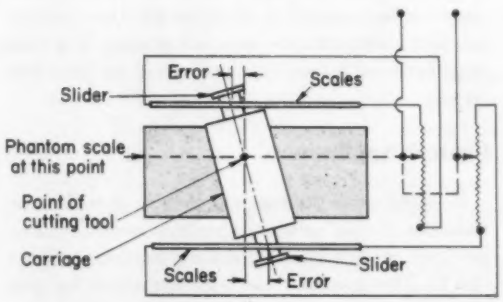


Fig. 7. Cocking of the carriage, however slight, should be compensated for in precision work. Establishment of a phantom scale by use of two Inductosyn controls can compensate for cocking.

of cutter path would be required during preparation of the program and only specific cutters could be used. Regrinding of the cutters for the particular program would be impossible.

Contour Machining: These controls can be applied as the positioning means in the design of complete systems for numerically controlling a milling machine with three axes. In this case, the path of the cutting edge of the cutter, not the center, may be computed and recorded on punched cards or perforated tape in the form of digital information. These cards are read into a digital-to-analog converter, which supplies the appropriate analog information to the analog control elements, permitting the machine to be servo-driven through the computed positions.

The computed path of the cutter is a continuous straight or curved line from a starting position to a command position. This provides for fewer computations than would be the case with a series of straight-line cuts.

Control by position insures minimum distortion and cutter path corrections are made as smooth curves rather than discrete steps. Machining of three-dimensional contours can be a completely automatic operation.

A system for controlling a machine in two axes and making cuts of selected slopes is also possible. Signals for the control of the X and Y sliders are produced from a pair of resolvers that are driven by a feed-rate motor. These resolvers are driven through adjustable-speed drives so that the ratio of their speeds is the tangent of the angle of cut desired. When the resolvers are driven at the same speed, for example, a 45-degree slope will be achieved. Other slopes are possible by changing the ratio of speeds.

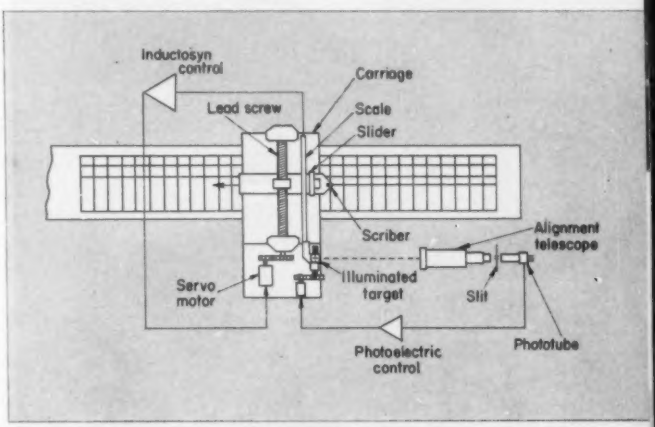
Electronic Gear Ratios: Rotary Inductosyns are useful in conjunction with analog-digital converters. For this they are applied as "electronic gear ratio" producers, notable because they operate without backlash. High accuracy can be obtained with relatively inaccurate cam or commutator type converters by driving such converters from the accurate high-speed shafts of Inductosyns.

Where binary numbers are to be used, it is convenient to construct the Inductosyn in 128-pole form, resulting in 64 cycles of variation per revolution. This is coarse enough so conventional devices, such as synchros or simple switch type analog-digital converters, can easily digitize the coarse part of the output. At the same time, 128 poles is a large enough number to allow precision of five seconds of arc.

If the decimal system is to be used, it might be convenient to construct the control unit with 100 or 200 poles. Where degrees are to be digitized, a control with 180 poles can be used.

It would be impossible to list all the uses for this or any other position control system because many potential uses are still unknown. Those listed, however, indicate the scope of operations that can be submitted to position control. One of the more startling features of such control systems is that they can make economical the programming for automatic production of a single part. Advantages for high-production runs are obvious.

Since an indefinite number of axes or movements can be controlled and interrelated by expanding basic systems, imagination of the tool engineer is the only limit to the utility of such control techniques.



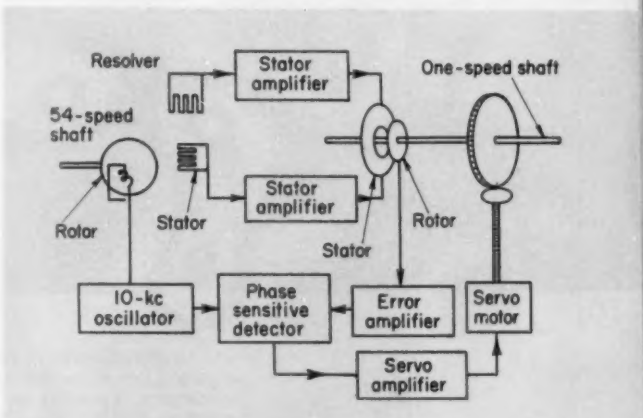


Fig. 8. (upper right) Through use of proper position control, including optical tooling, long, straight lines can be scribed accurately regardless of the machine accuracy.

Fig. 9. (lower right) Rotary Inductosyn can give the results of gear reduction without backlash.

designed for

PRODUCTION

LINEAR MECHANISM

controls feed to microinches

A LOGICAL successor to the lead screw for mechanisms requiring dimensional control in microinches, the Inchworm Motor is a linear actuator operating on the magnetostrictive principle. Armature of the motor shrinks under the influence of an electromagnetic field, snapping back to original size when the field is de-energized. A pair of clamps convert the armature expansions and contractions into forward or backward steps. Reversal of direction is accomplished without backlash. First application of this control has been in centerless grinders.

The stick-slip characteristic of massive machines with components on slides or ways has to be controlled before machine tool accuracy can be consistently within the millionths-of-an-inch region. Inchworms have reduced the minimum increment of slide motion in typical installations by as much as a factor of 15. Such installations have consistently repeated to an accuracy of ± 0.000005 inch under machine load conditions requiring a break-loose force of 300 lb and a sliding force of about 220 lb. Through a simple converter, this Airborne Instruments Laboratory unit can be applied to respond directly to gage signals.

TO PROVIDE relative motion between two bodies, each body is connected to one of the two moving Inchworm parts. Either part can be stationary, depending on the application. Connections between the members can be rigid. Piston pins are being centerless ground in this particular application.

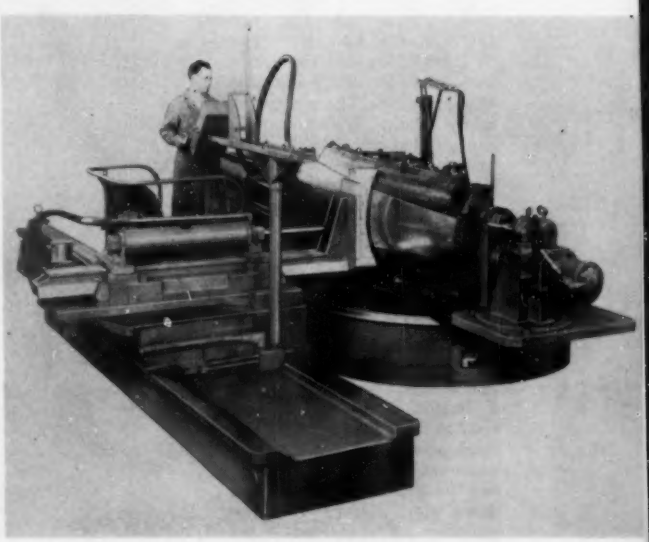
Draw-Forming Techniques Contour Tapered Sections

PARTS that taper from end-to-end or that vary in cross sectional area can now be formed in one operation. Conventional techniques cannot do this job because tonnages necessary to set the contour of heavy sections would fracture or overstress light sections. The new methods use a Cyril Bath radial draw form machine (tension cylinder with rotary table and contour die) with a transverse compression unit (hydraulic ram with wipe shoes to iron the material to the die contour).

In one method, the radial draw former stretch-forms the contour at tonnages suitable for the lightest section. Simultaneously, the hydraulic ram exerts pressure at the point of tangency between the material and the contour die, and progressively increases the pressure to accurately form the heavier cross sections.

In another method, the hydraulic ram is used as an auxiliary gripper. The wipe shoe is provided with a rubber-backed contact face that will conform to the contour die shape under pressure. The lightest sections of the workpiece are set by a low stretch tonnage. The ram shoe is then brought into contact with the material part way along the contour. It is forced against the part hard enough so that it acts as a gripper and the stretch tonnage can be increased to set heavier sections. Position of the ram and stretch pressure may be changed several times over the length of the part.

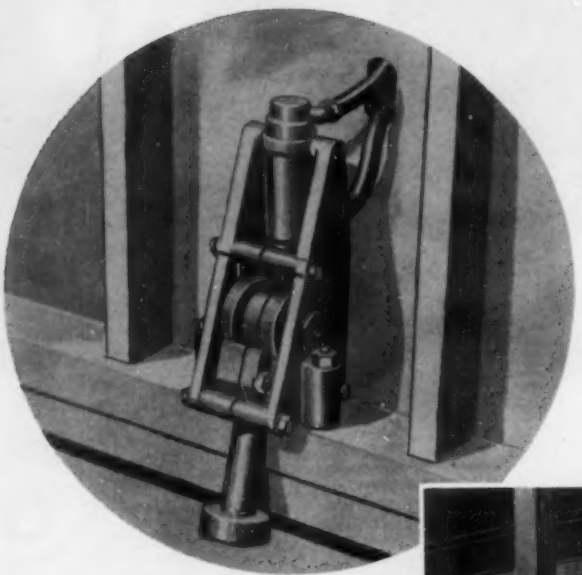
PARTS with these shapes previously had to be made by joining several short pieces or by machining the taper after setting the contour.



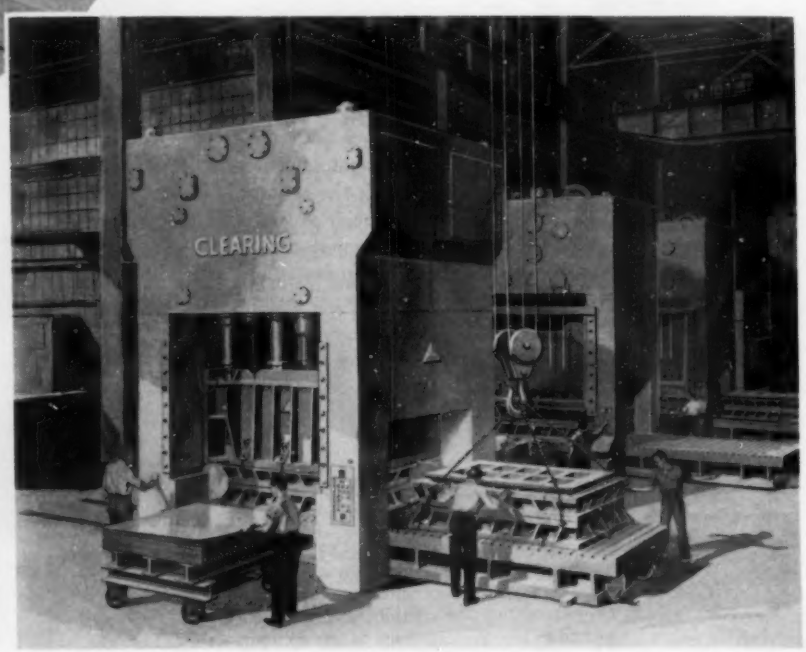
HYDRAULIC RAM can be used to iron the contour into heavy sections or can be used as an auxiliary gripper. For more complex contours, the ram end is a flexible wipe-face backed by a series of shoe segments. Shoe segments are hydraulically powered individually and are connected to flex the wipe-face to any contour.

Press Setups Completed During Run

MOVING on tracks through the die space, a double-size bolster plate enables tooling for the next run to be set up while completing a run. Die setting without down time can be used on all types of Clearing presses and can save substantial amounts where large equipment is used for comparatively short runs. In the aircraft industry, for example, die setting time often exceeds time spent for productive operation.

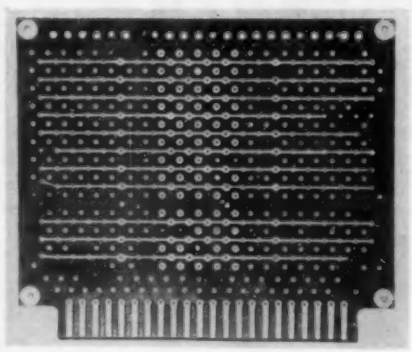


QUICK-CHANGE DIE "CLAMPS" avoid the job of manually loosening bolts when changing dies. The clamps, as many as are needed depending on the size of the press, are installed on the press slide and operate hydraulically.



ONE BOLSTER area is always outside the press in this unusual design. When a press run is completed, the touch of a button automatically unclamps the die punch. The slide is raised to clear and the outboard bolster is moved under the slide. The slide is run down and clamps the new punch.

Pantograph Drills Printed Circuit Plates Fast



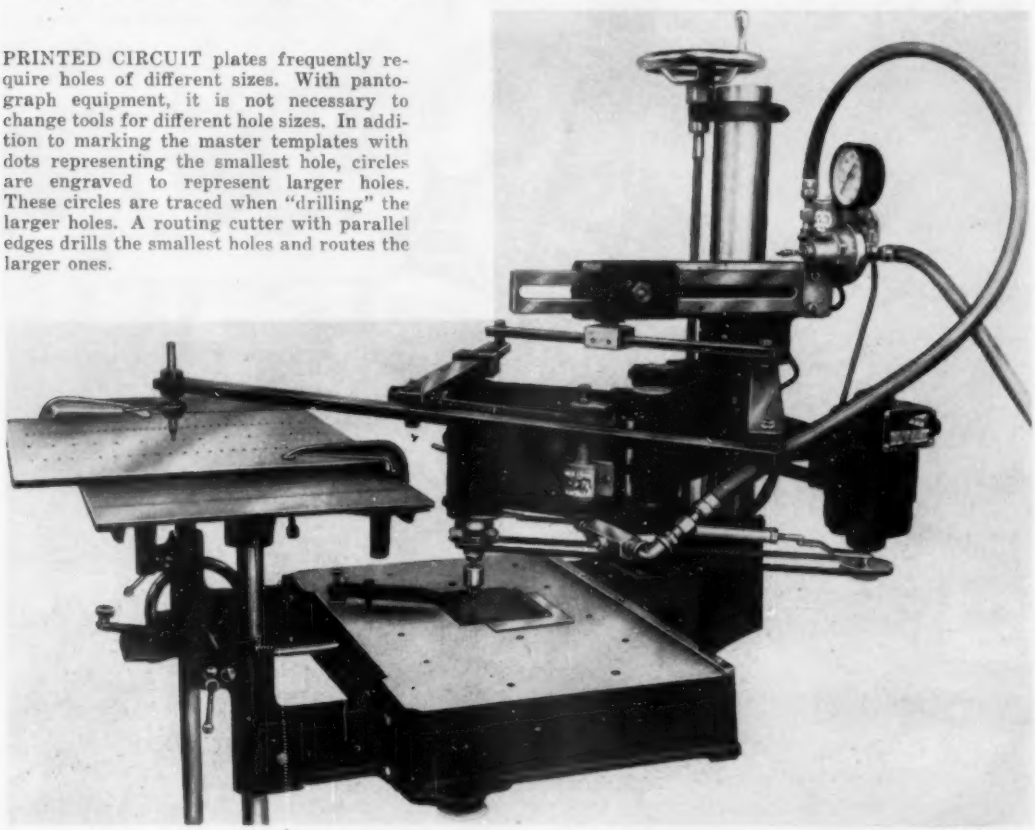
AN ENLARGED master template has dots representing the holes to be drilled in the printed circuit plate pattern. The dots are connected by grooves so the operator can quickly glide the tracing stylus of the pantograph from dot to dot. The feed is triggered each time the tracer contacts a dot.

DRILLING of printed circuit plates has been a production problem because it is not a fast process. Through use of a pantograph machine and an air-actuated feed attachment, it is possible to double or triple drilling rates. This high output is made possible through use of a tracer guiding technique.

The pneumatic attachment, which controls the feed, is actuated by a sensitive solenoid that can be operated by either hand, knee or foot. Automatic actuation results when the tracing stylus is placed in a dot in the master template.

One of the advantages of tracer-guided pattern drilling lies in the accuracy obtained. The New Hermes multiratio pantograph, for example, can be used with enlarged master templates in any ratio from 1 to 2, to 1 to 12. Slight errors in the template are reduced in the finished product by a factor equal to the pantograph ratio used.

PRINTED CIRCUIT plates frequently require holes of different sizes. With pantograph equipment, it is not necessary to change tools for different hole sizes. In addition to marking the master templates with dots representing the smallest hole, circles are engraved to represent larger holes. These circles are traced when "drilling" the larger holes. A routing cutter with parallel edges drills the smallest holes and routes the larger ones.

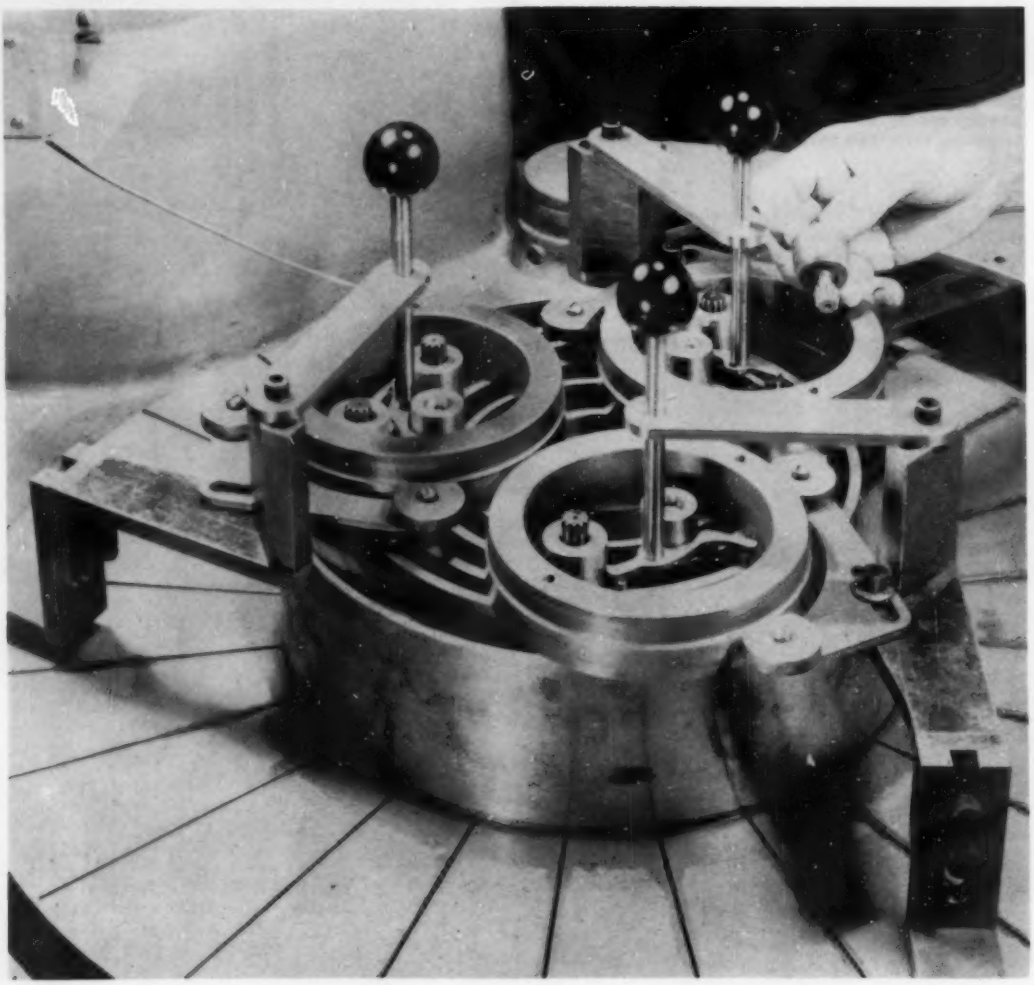


STANDARD MACHINE

Flat Laps

Shoulder Faces

FLAT lapping of shoulder faces can be done on a standard machine by use of special tooling. With a 12-inch, grooved lap plate mounted in the center of a 24-inch lap, shoulder lapping can be done without the cost of a separate machine. The auxiliary tooling can easily be removed for conventional operation of the machine. The same tooling arrangement can also be applied on 36-inch Crane Packing Co. Lapmasters.



GRINDING DIE BLOCKS
of Small Gear Dies

By Erik and Richard Lander
Radiation Laboratory
University of California

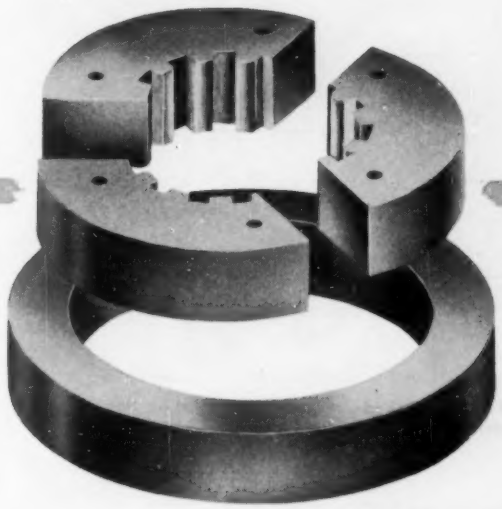


Fig. 1. Die block consists of three sections which are fitted into a containing ring.

Grinding tooth contours in the die blocks of small gear dies offers significant advantages over conventional filing or broaching methods. These advantages are discussed by the authors, who also describe a technique for fabricating small gear die blocks by grinding.

HIGH ACCURACY and a considerable savings in time are benefits derived from an unusual method of making die blocks used in small gear dies. The method consists of splitting the die block into three sections, grinding the sections to shape, *Fig.* 1, and fitting them together in a containing ring to make up the completed block.

Conventional methods for machining the contours of gear die blocks include filing and broaching. Filing is at best a time-consuming process, and broaching, while fast, must be done before heat treatment. Distortions caused by hardening can seriously affect accuracy. Grinding the contours, on the other hand, can be done on hardened stock, and tolerances can be held to within 0.0005 inches of specifications as measured over wires. Grinding is faster than broaching unless the required broaches are already at hand and produces an excellent finish.

Preparation of Die Sections: The first step in preparation of the die block is to machine a disk-shaped blank of suitable diameter and thickness.

This disk is split into three sections by sawing along the radii. Care should be taken to run each cut along a radius passing through the bottom of one of the tooth contours, in order to make the contours at the edges of the sections as strong as possible.

Subsequent alignment of the sections is simplified if the three sections are as nearly alike as possible. If the number of teeth is a multiple of three, 30 for instance, then all angles are 120 degrees and all sections are identical, having ten teeth each. For gears with 31 teeth, two sections would have ten teeth, and one section 11 teeth. If there are 32 teeth, the identical sections will have 11 teeth each and the other section ten teeth.

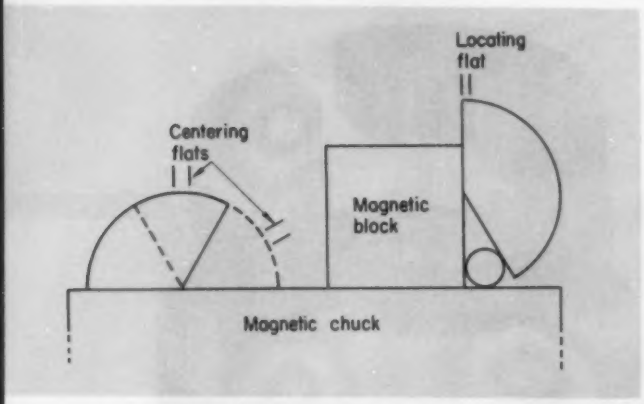


Fig. 2. Methods of grinding centering and locating flats in each die block section.

The three sections are aligned in a clamping ring for boring and turning operations. To facilitate alignment of sections in the ring, centering flats are ground on the circumference of each section, *Fig.* 2. Each flat is ground parallel to one of the radial faces of the section by placing that face down on a magnetic chuck and running a grinding wheel lightly over the top of the section. The surface of the flat should be large enough to accommodate the finger of an indicating dial.

A locator flat on each like section is useful for quickly aligning the three sections in the clamping ring. This flat is ground on the circumferences at the point where two like sections meet. To grind the flat, each section is placed with its radial face against a magnetic block mounted on a magnetic chuck, and is shimmed up by means of a pin. Use of the pin makes certain that the depth of cut is the same for both sections.

The two like sections are next placed in the clamping ring and approximately aligned by placing a straightedge across the locator flats, after which the third section is fitted into place, *Fig.* 3. Sections are held in position by screws. For final alignment, the ring and sections are mounted on an indexing fixture and rotated and adjusted until identical readings are obtained from all six centering flats.

Boring and Turning: Two locating holes are drilled and tapped in each die section so that it can be mounted on an adapter for boring and turning operations. These holes are used in determining the positions of holes used for locating during grinding of the teeth, so spacing of the holes must be the same in all sections. All holes should be centered on radii running through the bottoms of tooth contours in the die block, and holes in each section should be spaced as far apart as possible.

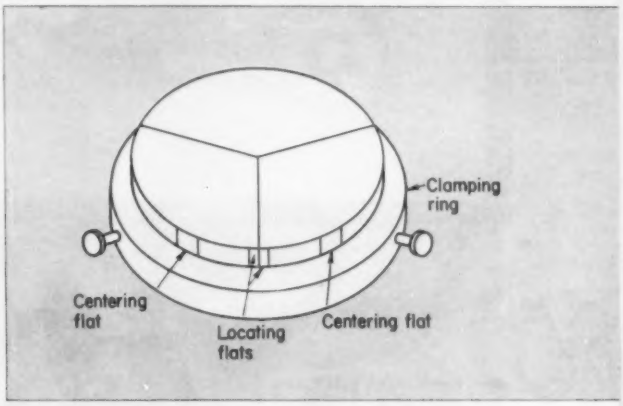


Fig. 3. Three die sections in clamping ring. Locating and centering flats are used to facilitate alignment of the sections in the ring.

The die sections, still in the clamping ring, are next screwed to the adapter plate for chucking purposes, *Fig.* 4, and the ring is removed. Outside edges of the sections are turned down a sufficient amount to remove the flats, and the inside edges are bored out to the correct ID, leaving grinding stock. This completes initial machining operations and the sections are removed and hardened.

Final Alignment: Following heat treatment, the top and bottom faces of the sections are ground flat, and the radial faces are ground to the proper angles. Centering and locating flats are again ground in the periphery of the die block, using the methods previously described. Alignment of the sections in the clamping ring is accomplished on an indexing fixture as before. After the sections are mounted on the adapter plate, the clamping ring is removed and the periphery of the die block is ground to fit a tapered containing ring which holds the sections in the completed die block. The ID is ground 0.005 inch undersize.

After being removed from the adapter, the sections are pressed into the tapered containing ring

and the unit is suitably mounted so that the excess 0.005 inch of stock can be ground away. This extra stock was allowed so that any slight difference between the alignment of the sections when screwed in the adapter and when fitted into the containing ring would not destroy the accuracy of the internal contour.

Grinding Tooth Contours: As previously mentioned, the tapped locating holes are used to roughly determine the position of holes used for locating during the tooth grinding operation. Soft plugs are screwed into each of the original locating holes. New locating holes, very accurately positioned, are drilled through the plugs, using a jig borer. This completes preparation of the sections for the tooth grinding operation.

Sections are held for grinding by means of an index plate, *Fig.* 5. Holes are spaced in the plate at angular intervals equal to the desired tooth interval of the die block. Centers of the holes lie on a circle whose radius is equal to the radius of the circle on which the centers of the locator holes lie. The set of holes is oriented so that when the top edge of the index plate is horizontal, a vertical grinding wheel is in position to cut a tooth in the die section. Individual sections are then mounted on the index plate by means of pins running through their two locator holes and into two holes in the index plate.

A grinding wheel, shaped to the correct tooth outline, is passed across the section until the desired depth of cut is reached. The section is then removed and rotated one interval for grinding of the next tooth. This process is repeated until all teeth in all sections are finished. Replacement of the sections in the containing ring completes the fabrication of the die block. Other components of the die, such as the punch and shedders are all made by standard procedures.

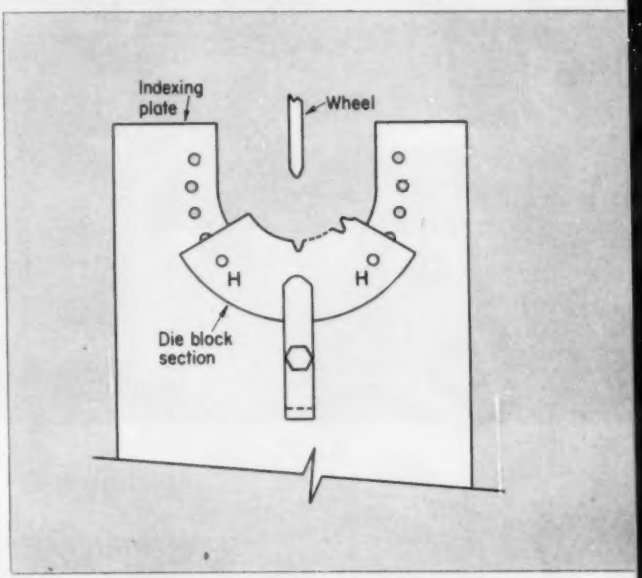
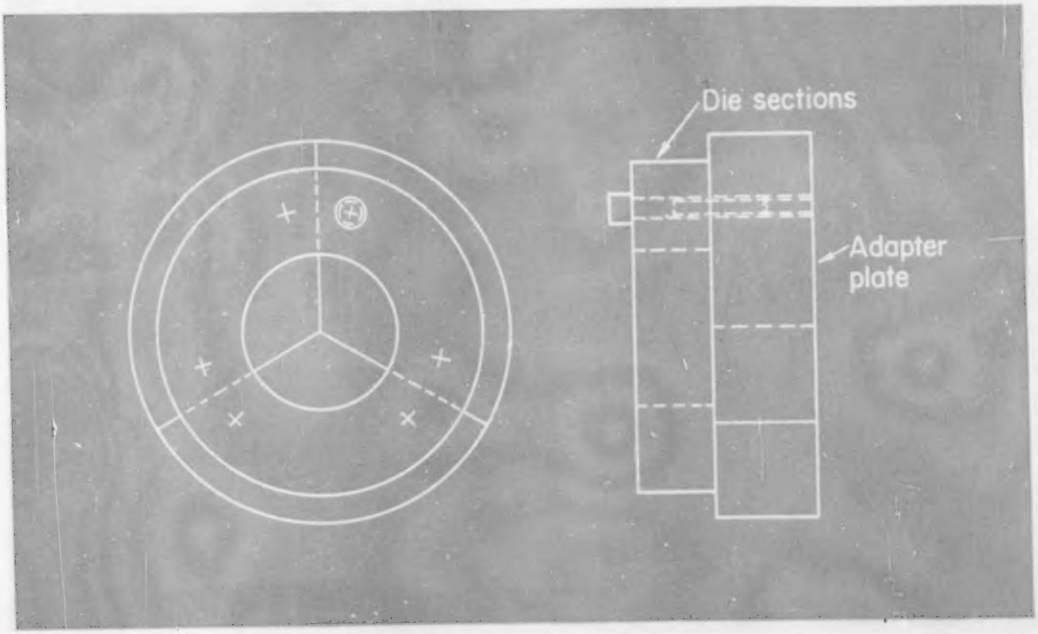


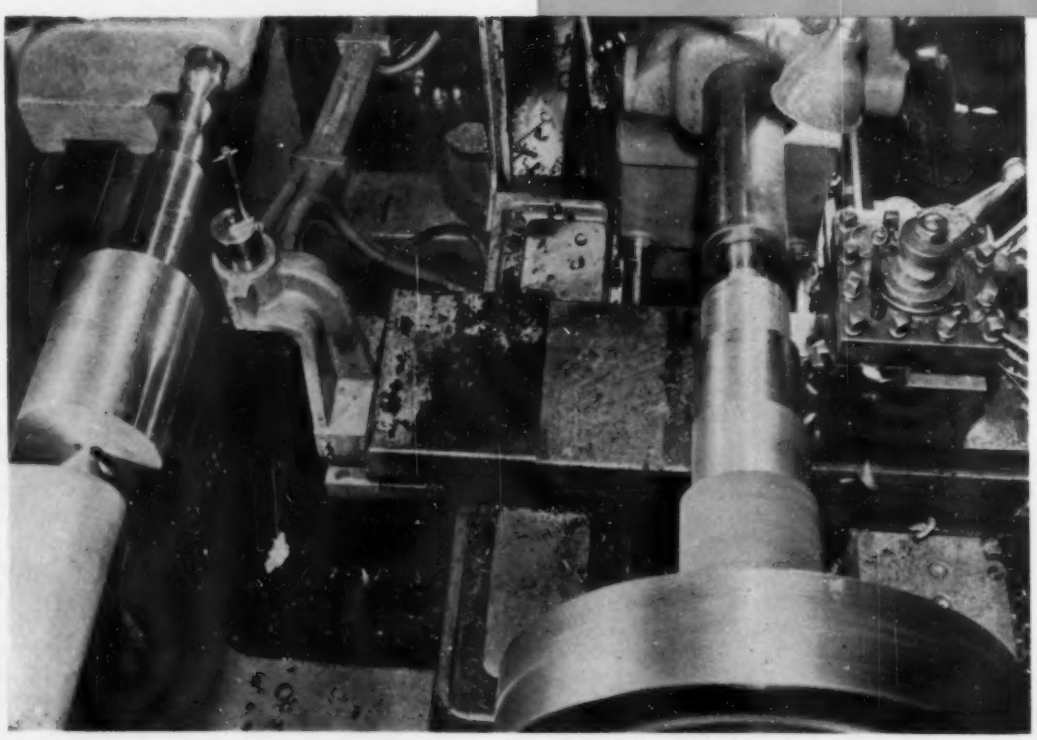
Fig. 4. (below) Die sections screwed to adapter plate for machining.

Fig. 5. (right) Setup for grinding tooth contours in one section of a die block.

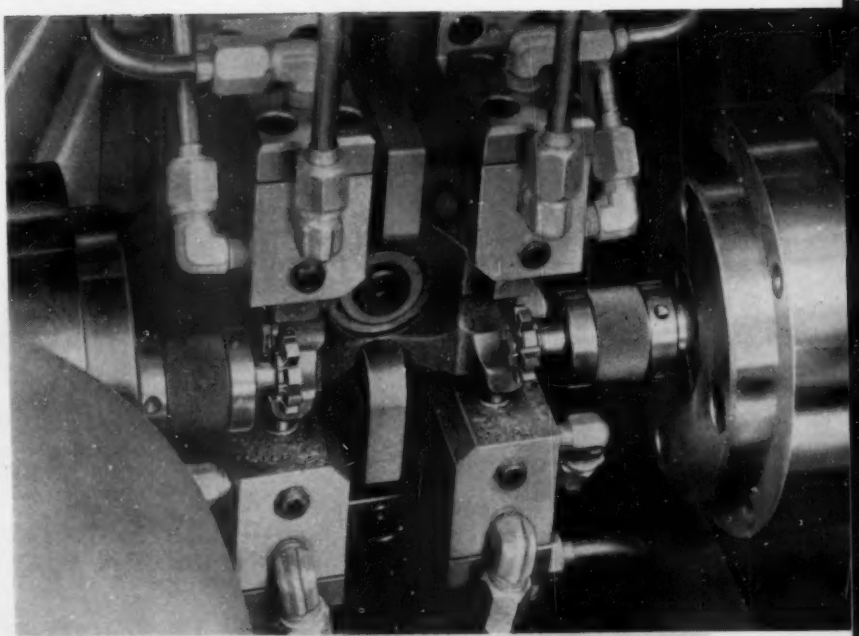


TURNING ECCENTRIC DIAMETERS on roller eccentric for a large drilling machine is accelerated by utilizing tracer lathe setup. By previous method, 14.1 hours were required to turn 102 pieces, whereas 120 parts were completed in 6.6 hours in the new arrangement for a savings of about 60 percent. Speed is 665 rpm, feed is 0.020 ipr and the cutting tools on this Lodge & Shipley machine are carbide.

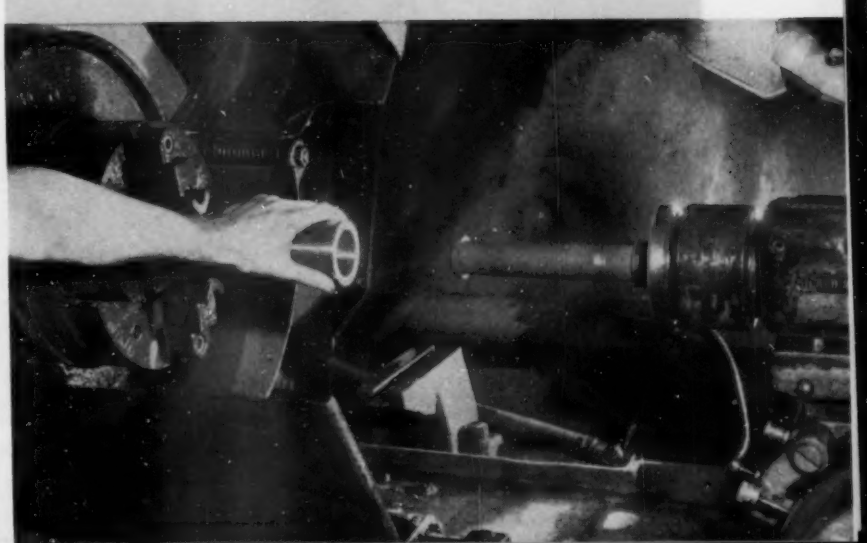
TRACER CONTROLS and carbide cutting tools team up in an operation removing 18 lb of metal per minute. The part is a 1020-steel roll for a journal produced at Improved Machinery Inc., Nashua, N. H. In the new setup, using Carboloy Grade 370 tool, the 22-inch roll is machined in 1½ hours, whereas formerly 6 hours were required. Speeds are between 500 to 800 sfpm, cuts range from ⅝ to ¾ inch with a feed of 0.021 inch.



TOOLS at work



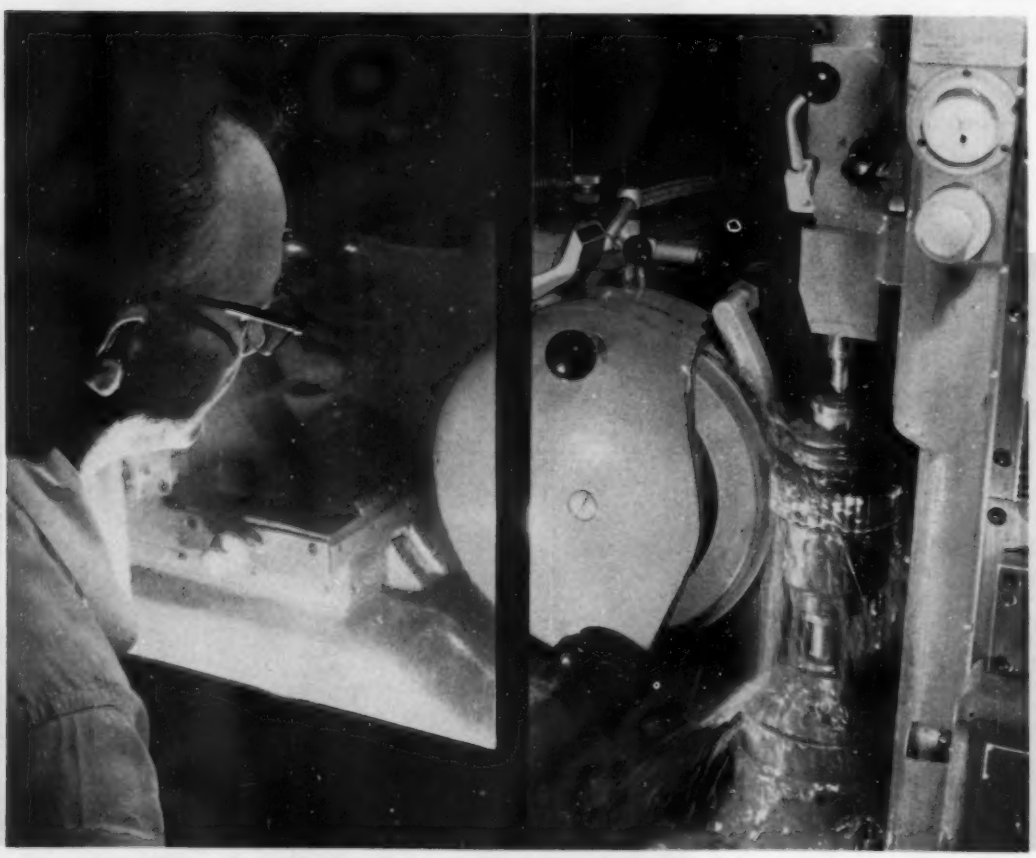
PRODUCTION is doubled in facing and undercutting operation on steel, propeller shaft pinion flange by means of special tooling. In addition, the double-end Ex-Cell-O boring machine has extra-wide bridges for transverse mounting of the spindles. The top part has been loaded while the second part is being machined. Continuous operation results in completion of 188 pieces per hour. The workpiece is held by pushbutton hydraulic clamps.

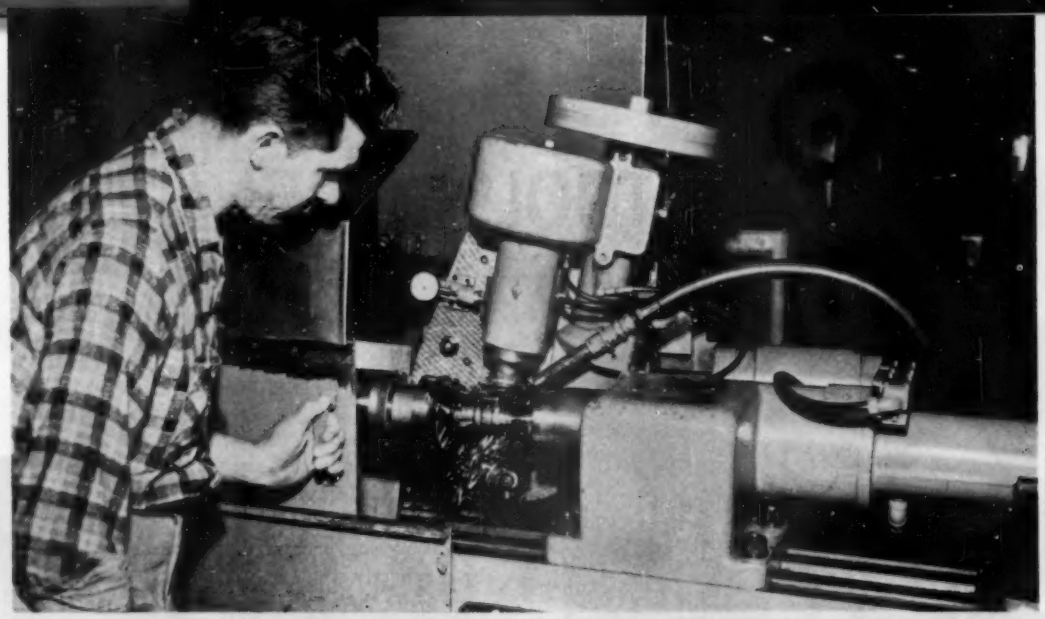


INTERNAL GRINDING of long cylinders is expedited by solid carbide grinding quill. The operation can be performed in half the time formerly required with a steel quill. Excessive deflection of the tool made repeated passes necessary to obtain required parallelism of bore and outer surface of the 12-in liner. With triple the stiffness of steel, the Kennametal Grade K-96 tool permits the cut to spark out quickly.

TOOLS at work

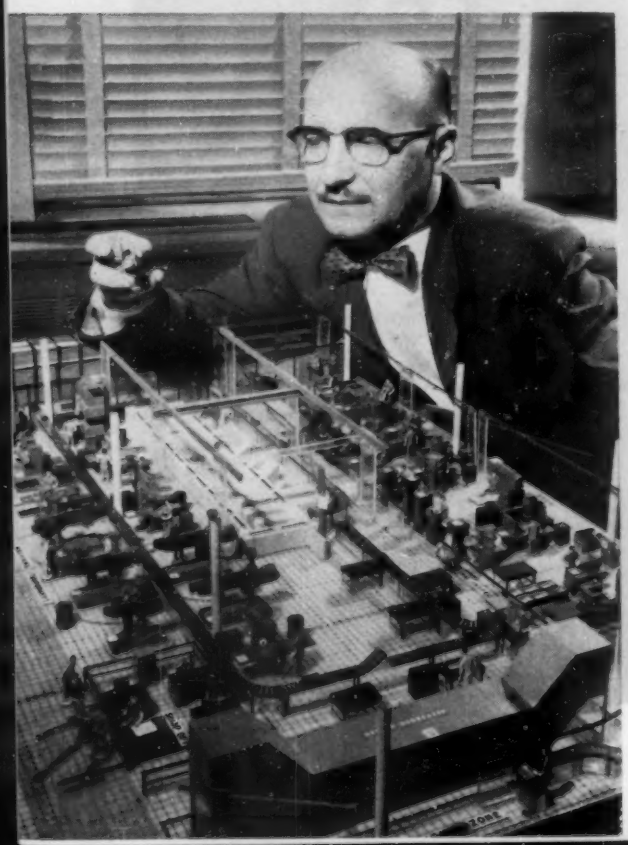
PRECISION GRINDING of spur gear for a machine tool is speeded with worm grinding wheel type grinding machine at Warner & Swasey Co., Cleveland, Ohio. With this setup, accuracy is held to 0.004 inch and typical gears are ground in ⅓ the time formerly required on conventional grinders.

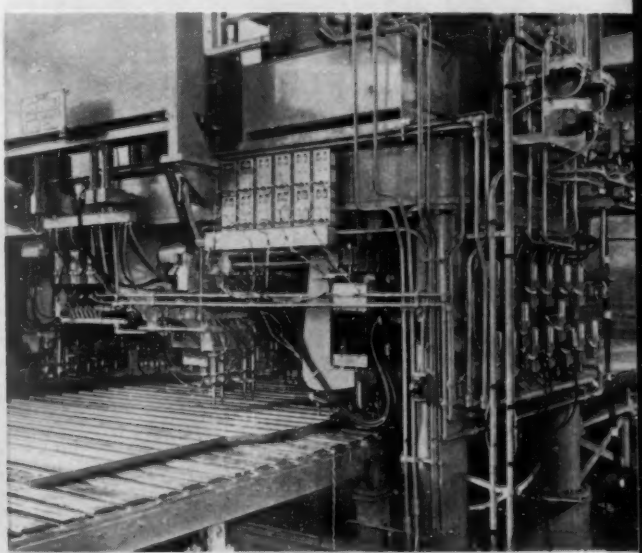




HOBBING STEERING GEAR SECTORS is speeded at Chrysler Corp. by setup utilizing special collet type holding and aligning fixture. This tooling overcomes effect of variations in the rough forgings. Hydraulically actuated tailstock maintains pressure on the part during hobbing to hold the part securely in the collet. Hourly production on the special Michigan hobber is 45 sectors, three times the previous output.

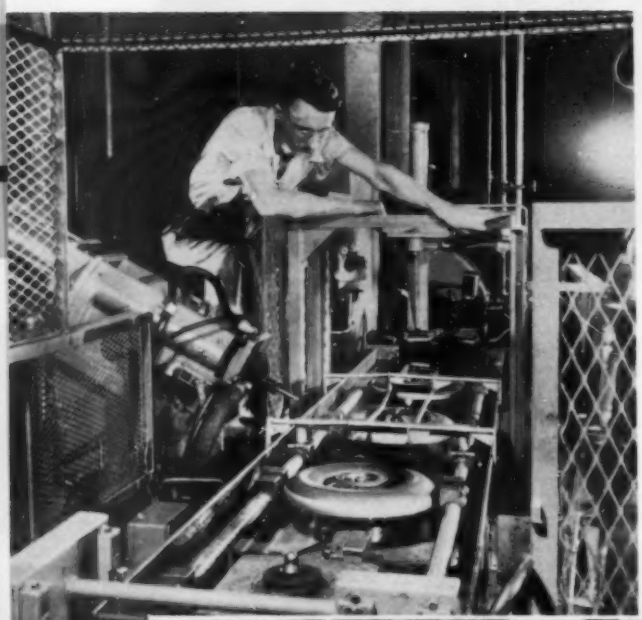
LILLIPUTIAN SHOP has an air of unreality about it that belies its tangible utility. Used in planning plant layout of manufacturing facilities at Westinghouse Electric Corp., its tridimensional models enables engineers to determine possible overhead interferences and take into account many other factors impossible by conventional methods.





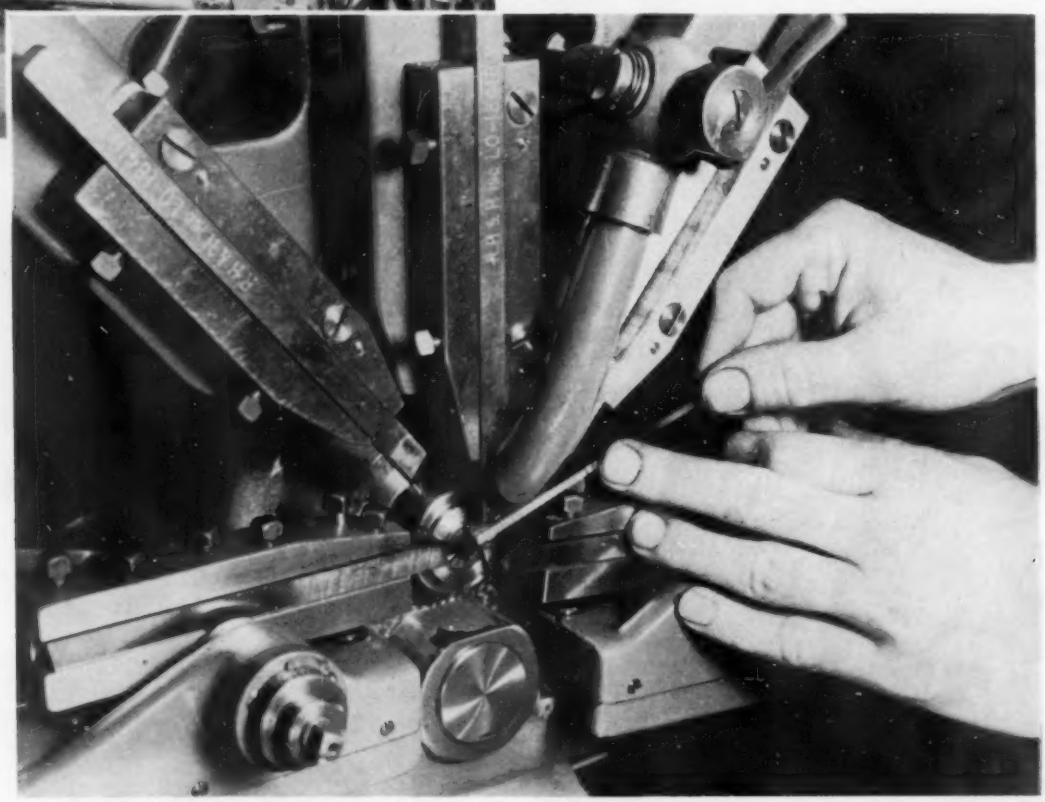
ASSEMBLY of corrugated high-tensile steel trailer sidewall is automatically welded in special spot-weld machine at Fruehauf Trailer Co. Piece-parts are preassembled on the table, then the welding machine takes over, indexing the parts under the heads. Every weld must be accurately located and timed. Control mechanisms of the special Link machine are electronic, electric and hydraulic.

TOOLS at work



PRECISION BALANCING of torus assembly is performed automatically at Detroit Transmission Div., GM. The special machine, developed by the research staff at the recently dedicated Tech Center, spins the part and an electronic computer determines location and amount of unbalance. In a succeeding station a metal slug, measured in thousandths of an inch, is properly welded to compensate for unbalance. Finally the torus is given another spin for a recheck.

DOWN TIME on Swiss type automatics is cut by dressing tools while still on the machine. The dressing tool is a Starlite diamond hand file shaped for this particular application, and providing fast-cutting action. Both steel and carbide tools are sharpened in this manner.



HOW to improve gear shaving operations

By Max B. Mentley*
Vice President of Mfg.
National Broach & Machine Co.
Detroit, Mich.

TOOL ENGINEERS can improve gear quality, prolong cutter life and reduce gear production tool costs by a carefully planned program. This includes proper preventative maintenance procedures and provision of adequate storage facilities for rotary shaving cutters.

These are precision-ground cutting tools. Accuracy of hole size, face runout, tooth spacing, form and lead are all held well within 0.0002-inch tolerances. Despite this built-in precision, shaving cutters will neither produce the proper form or accuracy on a gear tooth, nor will they provide maximum tool life unless they are properly used and maintained, *Fig.* 1.

Getting the most out of shaving operations is a matter of having:

1. Properly prepared gear blanks.
2. Correct preshave tooth forms and correct amount of stock removal.
3. Properly adjusted and well maintained machine.
4. Well designed tooling.
5. Proper coolant selection.
6. Correct shaving speeds and feeds.
7. Proper setup procedures.
8. Adequate inspection and resharpening procedures.
9. Proper shaving cutter handling and storage.

Facts About Rotary Shaving Cutters

Rotary shaving cutters, *Fig.* 2, are made of high-speed steel hardened from 63 to 65 Rockwell C scale and precision ground all over after hardening. Gashes in these cutters extend the full length of the tooth and terminate in a clearance space at the bottom of the tooth spaces. These clearance spaces provide unrestricted channels for a constant flow of coolant to rapidly carry away chips. Gashes in the teeth are of sufficient depth to permit several

*Senior member ASTE Detroit chapter.

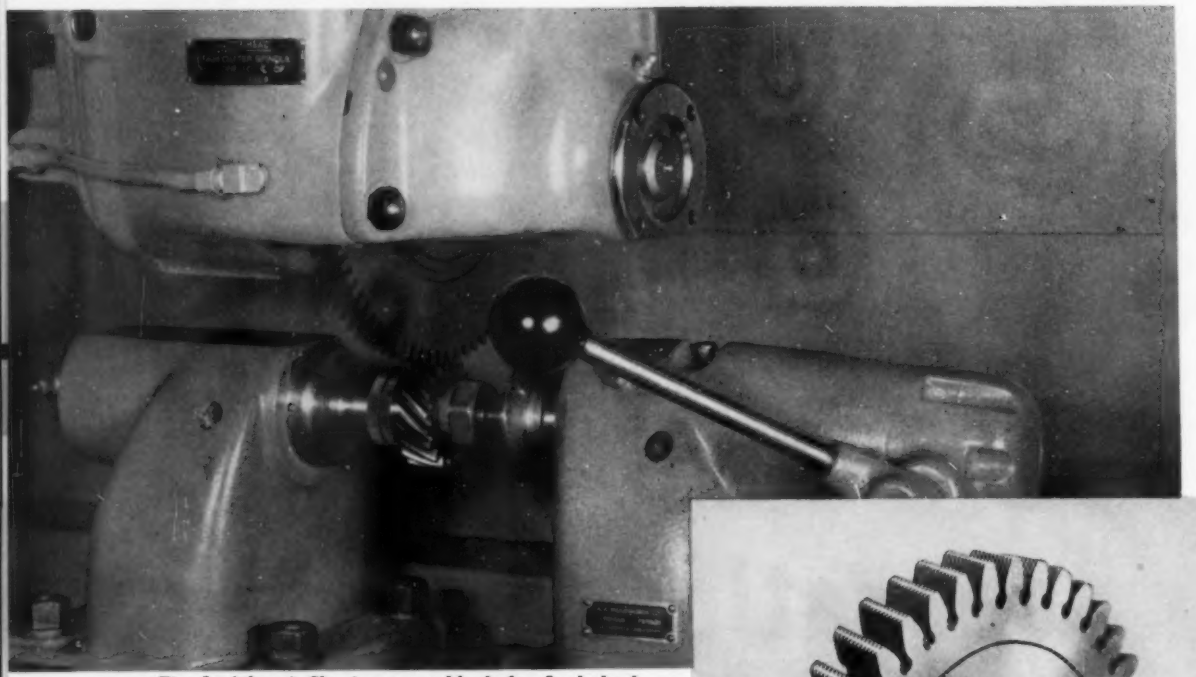


Fig. 1. (above) Shaving a test blank for final check of cutter accuracy.

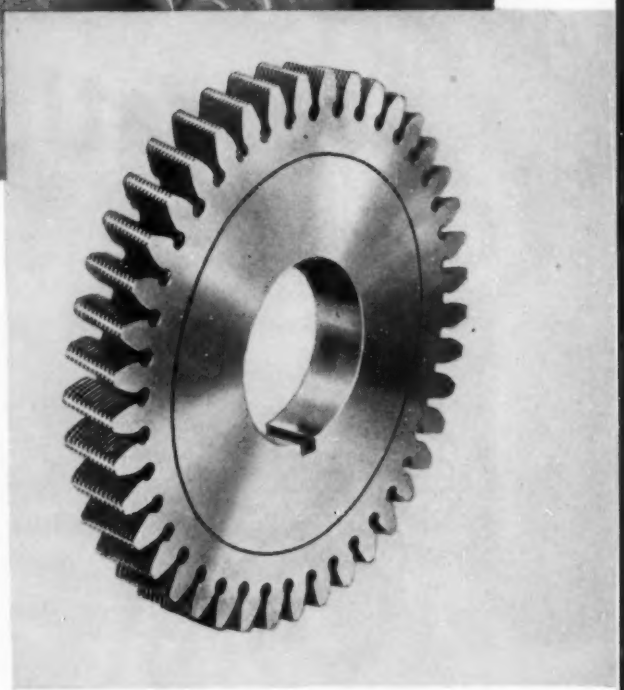


Fig. 2. (right) Typical rotary gear shaving cutter.

resharpenings of the cutter along the involute profile.

Gears having hardness values up to approximately 35-40 Rockwell C scale can be finished by such cutters. When gears require greater hardness, suitable allowance can be made in involute profile, lead and tooth thickness of the shaved gear to compensate for predetermined heat treatment distortions.

Preparation of Gear Blanks

Locating faces on gear blanks should be parallel with each other and square with the hole. The hole in the blank should be accurately sized so that it fits mounting arbors snugly. Gear faces, hole diameter and centers should be qualified ahead of all gear cutting operations.

If the gears are mounted on centers, these should be checked for true center angle and be free of nicks and burrs. Gears with splined holes can be located from the major diameter, minor diameter or sides of the spline teeth. It is extremely important that gears to be shaved be clean and free of scale.

Another important point that tool engineers should watch in the processing of shaved gears is the presence of work hardened surfaces on the gear blanks resulting from excessive stock removal with carbide tools. It may be necessary to reduce carbide turning speeds and feeds on high carbon or high alloy steel gear blanks to assure that cold working of the surfaces does not harden them to a point where the life of hobs, shaper cutters and shaving cutters is shortened. Not only do work hardened surfaces lower tool life, but they also reduce the quality of the finish-shaved gear.

The amount of stock removed by a shaving cutter is often the key to the success of a shaving operation. Best results are achieved when hobbed or shaped gears are of sufficient accuracy that only a small amount of stock must be removed by the shaving center. Useful life of the shaving cutter can be

considerably shortened and work accuracy noticeably reduced if too much stock is removed from the gear teeth in the shaving operation.

The shaving of gear teeth with minimum stock removal depends on several factors. For one thing, hobs and shaper cutters must be kept in good working condition. They should be kept sharp and be sharpened correctly. These tools should be designed to accurately produce the desired preshave pressure angle, root diameters and fillets as well as any desired protuberance undercut. Correct hobbing and shaping speeds and feeds as well as precise size control assures that the shaving machine can do its best job.

A shaving tool should not be expected to make major corrections in pressure angle or lead. Nor should it at any time engage root diameters or fillets. Any of these conditions will result in poor work quality and short cutter life.

It is well known that the profiles of case hardened gears tend to shrink and give a "minus" involute profile measurement after hardening. Through-hardening steel gears, on the other hand, results in expansion of the teeth and a subsequent "plus" profile reading after hardening. For this reason, certain compensations are made in the profiles of the unhardened gear teeth to allow for these shrinkage or expansion conditions. The shaving cutter should not be asked to make all the profile correction, since this means that either the bottom or top of the shaving cutter tooth is going to be overloaded in the shaving operation, and minimum work quality and tool life is the inevitable result. The profile of the hob or shaper cutter should be modified to compensate for heat-treat change as well as for any desired tooth modifications such as tip relief, rounded profile or protuberance, so that the shaving cutter removes a uniform amount of stock the entire length of the tooth profile.

The same consideration holds true with respect to the lead of a helical gear. These leads lengthen or shorten in hardening depending on the type of steel and this change must be compensated for. The proper way to accomplish this compensation is by changing the lead of the hobbed gear by gear train changes or changing lead of the shaper-cut gear with suitable helical guides. If all of these form and lead compensations are made in the preshave tooth cutting operations, the shaving cutter will produce extremely accurate gears while providing maximum tool life. Given in Table 1 are recommended amounts of stock to be removed by shaving the various tooth diametral pitches.

Shaving Machine Requirements

The accuracy that a rotary shaving cutter will produce in a work gear is directly dependent upon the condition of the shaving machine itself. The cutter spindle should run within 0.0005 inch on the outside diameter and within 0.0002 inch on the flange. Head and tailstock centers should run true.

Bearings should run out no more than 0.0003 inch; centers within 0.0002 inch. The shaving machine table and knee should be kept in tight adjustment at all times. End play in the cutter spindle is another condition to be avoided.

Good shaving machine practice dictates that rigid, accurate tooling be utilized. Work gears should be shaved from the locating points or surfaces that were used in the previous tooth hobbing or shaping operations. Locating points on arbors and fixtures should be held to a total tolerance of not more than 0.0002 inch.

The type of coolant and condition of contamination of coolant have a direct bearing on cutter life and quality of shaved tooth surface finish. Too thin cutting oil or cutting oil that contains chip particles can cause scratched surfaces on the gear teeth. A cutting oil of about 150 viscosity is recom-

Hints To Prolong Shaving Cutter Life

1. **Inspect cutters periodically during use for packed gashes caused by loose hob or shaper chips left on the gears. This will avoid breakout of the cutters at the lands.**
2. **Check shaving machine table adjustment periodically. If the table becomes too loose, tooth spacing irregularities and tapered teeth result.**
3. **Check knee adjustment. A loose knee causes variations in lead, tooth spacing and involute form.**
4. **Check cutters to prevent excessive dullness, which increases the amount of stock that must be removed in resharpening and reduces cutter life. Further, dull cutters may break in operation because of increased cutting pressures.**
5. **Avoid excessive stock removal. Cutter tooth failure or excessive dulling will result.**
6. **Avoid shaving gears with hard spots. These reduce cutter life materially.**
7. **Periodically check cutter bores and machine spindles for squareness and runout as well as end play.**
8. **Avoid shaving extremely soft stock or using cutting oil of insufficient body. Galling and loss of tooth surface finish result.**
9. **Check coolant periodically for chip contamination. Chips in coolant result in poor tooth finish.**

Table 1—Recommended Shaving Stock Removal for Various Tooth Pitches

Normal Diametral Pitch	Total Shaving Stock on Tooth Thickness (inch)	Normal Diametral Pitch	Total Shaving Stock on Tooth Thickness (inch)
2.5	0.0030 - 0.0040	20.0	0.0005 - 0.0015
3.0	0.0030 - 0.0040	22.0	0.0005 - 0.0015
3.5	0.0030 - 0.0040	24.0	0.0005 - 0.0015
4.0	0.0030 - 0.0040	26.0	0.0005 - 0.0015
4.5	0.0030 - 0.0040	28.0	0.0005 - 0.0015
5.0	0.0025 - 0.0035	30.0	0.0005 - 0.0015
6.0	0.0025 - 0.0035	32.0	0.0005 - 0.0015
7.0	0.0020 - 0.0030	36.0	0.0005 - 0.0015
8.0	0.0020 - 0.0030	40.0	0.0005 - 0.0015
9.0	0.0020 - 0.0030	44.0	0.0005 - 0.0015
10.0	0.0020 - 0.0030	48.0	0.0005 - 0.0015
11.0	0.0015 - 0.0025	52.0	0.0003 - 0.0007
12.0	0.0015 - 0.0025	56.0	0.0003 - 0.0007
14.0	0.0015 - 0.0025	60.0	0.0003 - 0.0007
16.0	0.0010 - 0.0020	64.0	0.0003 - 0.0007
18.0	0.0010 - 0.0020	72.0	0.0003 - 0.0007

mended for gear shaving operations. Magnetic chip separators in coolant systems prevent undesirable chip problems.

Shaving Speeds and Feeds

As a general rule, rotary shaving cutters are run at a speed of approximately 400 surface feet per minute. Usually a cutter rpm corresponding to this surface speed is selected as a starting point and then the cutter's speed is increased or decreased as necessary.

For best results in gear shaving, a feed of approximately 0.010 inch per revolution of the work gear is used. The formula used to obtain the table feed in inches per minute is:

$$\text{Table Feed} = \frac{\text{Cutter rpm x No. of Teeth in Cutter}}{\text{No. Teeth in Gear x 0.010}}$$

The class of finish required, the type of gear material and the desired production rate are all factors that enter into the selection of table feed. If the gear being shaved is larger than the cutter, cutter speed is increased or the table feed decreased. This statement applies to small-diameter, fine-pitch cutters only. If the gear being shaved is much smaller than the cutter, the cutter speed is decreased or the table feed increased. Small gears or heavy gears should not be shaved at excessively high speeds.

The vertical feed table, which reduces the center distance between the cutter and work in increments until proper work gear size is reached, depends upon the type of shaving process used. With angle feed or diagonal shaving methods, it is possible to shave a gear without table feed, the cutter passing forward and back across the gear only once.

Automatic upfeed mechanisms are available with selector plates and master cams which permit the preselection of upfeed and dwell increments. Manual vertical feed can also be performed on rotary shaving machines where axial feed or conventional shaving methods are used. A vertical feed of 0.0005 inch to 0.003 inch per table reciprocation can be considered as an average figure.

Cutter Setup Procedures

Care should be exercised in mounting a cutter on a shaving machine to avoid damaging the cutter as well as to assure proper mounting. During the mounting operation, cutters should be placed flat, preferably on wood, and away from any steel objects. The slightest contact with any hard object will nick the cutter teeth and thereby produce a scratchy finish on the shaved gear.

The inside diameter of the cutter is designed to be a sliding fit on the upper spindle. Before the cutter is mounted on the spindle, the spindle and spacers should be thoroughly cleaned. If the cutter seems to fit too tight on the spindle, the key should be examined for burrs. In any instance, the cutter should not be driven on the spindle with a lead hammer. After the cutter is assembled on the spindle and the spindle nut is tightened, the cutter face is indicated, *Fig.* 3, to check mounting accuracy.

Before a newly mounted cutter is allowed to contact the work gear the shaving machine should be cycled one or two times to thoroughly wet the cutter with coolant. This prevents cutter galling.

Fig. 3. Checking runout of shaving cutter on shaving machine arbor.

Glossary of Terms

AXIAL TRAVERSE CUTTERS (also called "Conventional" or "Transverse"),

Cutters for use when work is traversed back and forth in mesh with the cutter in a path parallel to the work axis and is fed in increments to depth at the ends of the traverse. The work and cutter center lines are in crossed axes relationship.

ANGULAR TRAVERSE CUTTERS (also referred to as "Diagonal"),

Cutters for use when work is traversed back and forth in mesh with the cutter in a path, at an angle to the work axis. It may be fed in increments to depth at the ends of the traverse. The work and cutter center lines are in crossed axes relationship.

RIGHT ANGLE TRAVERSE CUTTERS (also referred to as "Tangential"),

Cutters for use when work is traversed back and forth in mesh with the cutter in a path at right angles to its axis. Work and cutter center lines are in crossed axes relationship.

PLUNGE FEED CUTTERS

Cutters for use when work meshes with the cutter and is fed to depth without traverse. Work and cutter center lines are in crossed axes relationship.

PARALLEL AXES CUTTERS

Cutters for use when work and cutter center lines are on parallel axes. The work is traversed back and forth in mesh with the cutter and fed in increments to depth at the ends of the traverse.

CROWN SHAVING CUTTERS

These cutters have constant-thickness teeth. A crowned tooth surface is produced by rocking the work axis while using either axial traverse or parallel axes methods.

REVERSE CROWNED SHAVING CUTTERS

These cutters have concave tooth surfaces. Crowned gear teeth are produced when angular traverse, right-angle traverse or plunge feed methods are used.[1]

HAND OF CUTTER

A right-hand cutter has a helix that twists away from the observer in a clockwise direction when viewed from either side. Left-hand cutters twist away from the observer in a counterclockwise direction when viewed from either side.[2]

SERRATIONS

Narrow grooves on the cutter teeth between the lands that form the cutting edges.

1. **Transverse serrations have sides perpendicular to the cutter axis.**
2. **Normal serrations have sides perdendicular to the tooth flanks.[3]**
3. **Serration width is the width of the grooves in the tooth flanks.**
4. **Serration land is width of the tooth flank sections between the serrations.[4]**
5. **Clearance holes are the holes at the root of the shaving cutter tooth spaces, which provide clearance for serration generating tools and coolant distribution.**

[1] Axial traverse, angular traverse and parallel axes shaving cutters can be identical, but they may have different serration designs. Right-angle traverse cutters are wider than the gear and have modified serration designs. Plunge feed cutters are also wider than the gear and may have modified lead.

[2] When external helical gears are shaved by rotary gear shaving processes, the hand of the cutter is opposite from that of the work. Internal helical gear shaving cutters have the same hand as the work. When shaving internal or external spur gears, the hand of the cutter may be either right or left, depending on the application.

[3] Sides of serrations may be parallel or in angular relationship to form a buttressed land section.

[4] On axial traverse cutters the serrations on successive cutter teeth usually are in line. Rotary gear shaving cutters for other types of processes have serrations in staggered relationship on successive teeth or on a helical lead path about the cutter axis.

Extreme care must be exercised in making the angular setting of the cutter spindle head on the shaving machine. This setting should be readjusted whenever a cutter change is made on the machine, since the operating pitch diameter and helix angle of the cutter changes with each sharpening.

Proper angular setting is achieved by hand rotating the work in mesh with the cutter and adjusting the angular setting until a good bearing is obtained at the minimum backlash position. No power drive or cramping action should be initiated during this setup operation. This will avoid breaking the cutter teeth due to the twisting forces set up by a cross-bearing condition.

Inspection and Resharpening

The accuracy of a rotary gear shaving cutter is best judged by measurement of the gear tooth surfaces it generates. All rotary gear shaving cutters have profiles modified in small amounts by the supplier to produce a gear of a given size and tooth form. Checking of such cutter elements as involute profile thus has no real meaning as far as the user of the tool is concerned. Desired accuracy of shaved gears can be best achieved by specifying the exact gear tooth and size requirements for the shaving operation. Accurate involute profile, spacing, lead and eccentricity of the shaved blank provide maximum

assurance that the cutter will produce a gear with the desired specifications.

Rotary shaving cutters can be resharpened from three to six times depending upon the pitch of the gear. On the average, up to 10,000 pieces can be shaved per grind of the cutter. Common practice is to send rotary shaving cutters back to the shaving cutter supplier for resharpening.

Dullness of shaving cutters is indicated when oversized gears are produced. A poor finish on the work gear teeth is also an indication of a dull cutter.

Another method of detecting a dull cutter is to remove it as soon as involute profile errors are detected in the work gear. This results from normal wear of the cutter which tends to produce a plus form on the involute profile. Where heat treatment errors are being compensated for by shaving operations, the cutter should be removed when this profile error occurs. When the cutters are received, the tool manufacturer puts them through a rigid receiving inspection operation, *Fig.* 4, to determine the amount of wear and any damage the cutter may have received in use. Then the cutters are resharpened on specially designed tooth form grinding machines, *Fig.* 5, in temperature-controlled, soundproofed rooms. Precision involute profile, spacing, size, runout and lead checks assure that the resharpened cutters meet specifications.

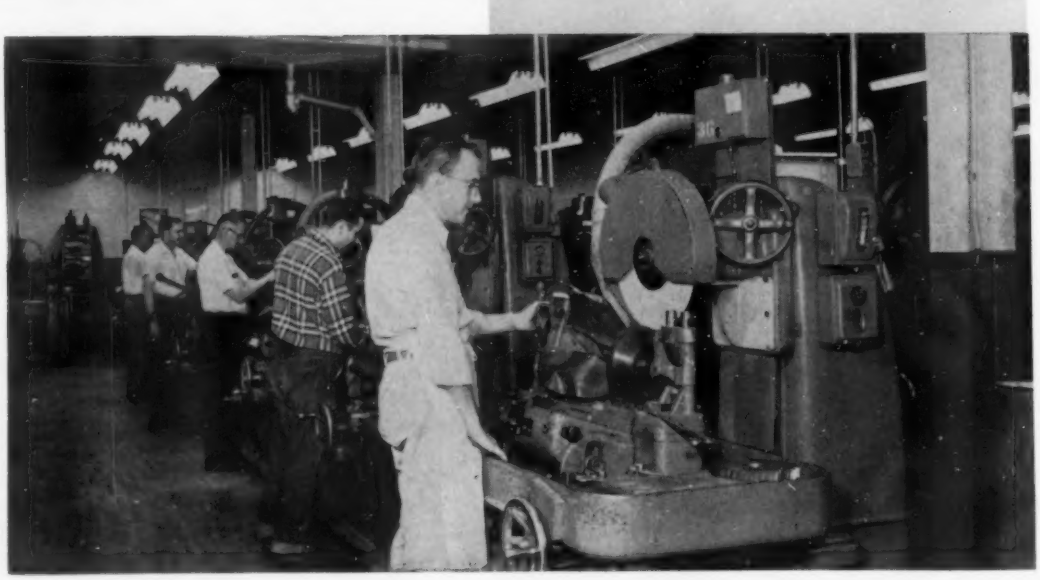
Repairing Broken Shaving Cutters

In spite of extra precautions, shaving cutters do become damaged due to improper handling. If some of the serrations on a tooth in a cutter are broken out, it is only necessary to hone the sharp edges and put the tool back on the machine.

If teeth or portions of teeth are broken out of cutters, a different condition exists. Cutters with partially broken teeth will operate satisfactorily for a time if they perform the shaving operation with-

Fig. 4. (left) Inspecting a dull cutter before resharpening determines amount of damage or wear.

Fig. 5. (below) Resharpening rotary shaving cutters on special form grinding equipment.



out making a knocking noise. When shaving cutters knock, it is an indication that too much of a tooth has been broken out to assure adequate tooth contact ratio. In this case, the cutter should be returned to the tool manufacturer and a new tooth inserted in the cutter to effectively prolong its useful life.

Shaving Cutter Storage

From the day a rotary gear shaving cutter leaves the supplier it should receive the best of care in transit to the customer, in handling by the customer and in shipping back to the supplier for regrinding. Cutters are expensive precision tools that can easily be damaged by nicking or their useful life reduced by corrosion.

Shaving cutters are usually packed by the supplier in special sheet metal containers, *Fig.* 6. They are greased, wrapped in vaporproof paper and tightly wedged in the containers with corrugated board around the OD and sides. When a small quantity user receives the cutters he should keep them in the containers. If the customer carries a large stock of cutters and has many cutters in process, he can take them out of the containers and store them in wooden storage bins, *Fig.* 7, with individual pockets for each cutter. The cutters should never touch each other nor should they come in contact with metal shelving. If stored in wooden bins, the cutters should be thoroughly greased to prevent rust or corrosion of all surfaces, including the center hole. When returned to the supplier for resharpening, they should be repacked in the containers in which they were received, with both the vaporproof paper wrap and the corrugated board packing.

Gear shaving cutters should be stored in a room at moderate temperature from 70 to 80 F. They should not be stored in an unheated area in the winter or too close to an outside window. Neither should they be stored over a radiator or steam pipes or near magnetic sources. Similar thought should be given to summer storage.

Shaving cutters should be thoroughly cleaned and checked for magnetism after removal from the containers and before installation on the shaving machine.

These are some of the considerations governing rotary shaving cutters and their use in the metalworking field. By following these rules optimum service can be obtained at lowest cost.

Fig. 6. (left) **Recommended type of shaving cutter container.**

Fig. 7. (above) **Wooden stock racks for storing shaving cutters.**

Special Fixture Speeds Inspection

By C. T. Bower
London, England

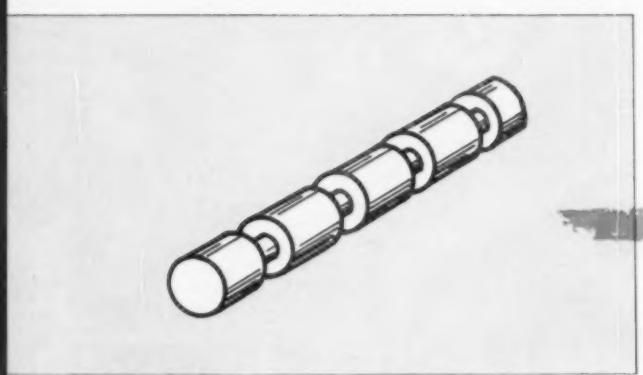


Fig. 1. Spool type hydraulic valve.

Where production quantities permit, a special fixture is often the answer to inspection problems. The fixtures must be economical to fabricate, easy to use, capable of adjustment for wear, rugged and accurate. These characteristics are illustrated by the inspection fixture described by the author.

EDGES OF GROOVES in spool type hydraulic valves must be accurately located with respect to one or both of the end faces since the grooves act as passages for the transmission of hydraulic fluid to ports in the valve housing. When both ends of the valves act as cut-off surfaces, the over-all length is also critical. The valve illustrated, *Fig.* 1, has four grooves, making a total of eight faces plus the end face which are gaged to determine if they fall within a plus or minus 0.001-inch tolerance range.

A fixture initially made for this purpose proved to be unsatisfactory in service. The fixture consisted of a vertical pillar to which nine radial arms were attached. Each arm supported a dial gage of the pivoted finger type. With the valve on end, the gages were swung into position individually to measure the location of the upper and lower faces of each groove and the over-all length of the component. Because of the large number of dials employed and the mounting method used, the fixture was easily knocked out of adjustment, making it necessary to frequently check and reset the gages.

It was apparent that a more compact and durable gaging fixture was needed and an improved design was evolved, *Fig.* 2. Only two dial gages are used: one to measure the deviation of upper faces and the other for lower faces. The gages are shifted from one groove to another by means of a spacing device

which is preset to place them in the correct position in relation to the end face of the valve.

One end of the valve stands on a hardened plug pressed into a soft steel supporting block welded to the fixture base plate. The valve is supported in an upright position by a magnet which holds it against a vertical V-block.

The dial gages are attached to a mount which slides vertically on a pillar. A stepped sleeve, made of aluminum alloy to reduce weight, comprises the spacing device. Sliding clearance between the sleeve and the pillar is kept to a minimum and the bearing surface is long to minimize any tendency for the sleeve to rock.

Five steps are milled around the exterior of the sleeve. Each step on the sleeve corresponds to one gaging position on the valve being checked. A hardened steel locating plug is placed in the center of each step, with its face projecting slightly below the surface of the step. Upper ends of the plugs are threaded to engage tapped holes in the sleeve. By means of the thread, the setting of the locating plug faces can be adjusted so that the vertical distance between any two plug ends is equal to the nominal distance between two adjacent grooves on the valve. Setscrews lock the plugs in position.

The gages are mounted on a knurled collar which has a long sleeve to increase the bearing length. This sleeve fits inside the stepped sleeve, making it possible to rotate the collar when positioning the gages, carrying the fingers of the gages clear of the grooves in the valve.

To raise the gages level with successive grooves, the stepped sleeve is turned so that the hardened plug in the next step rides onto a fixed pin screwed into the fixture base plate. This pin can be adjusted vertically to alter the position of the stepped sleeve relative to the grooves in the valve, an adjustment which is necessary only when the job is being set up and to compensate for wear. A spring-loaded ball detent in each step, in *Fig.* 3, insures proper alignment of the plug with the fixed pin and prevents the stepped sleeve from turning when the gages are positioned horizontally. The balls engage with a groove running vertically up the pillar.

Once the locating plugs in the stepped sleeve have been set precisely to correspond to center lines of the grooves on the spool, the two dial gages can be set to a small gap gage resting on the plug used to support the valve in the fixture. Alternatively, a pile of gage blocks can be made up in the form of a gap gage and used for setting the gages. Periodic checks on the stability of the gage setting can be carried out very quickly by either of the above methods. Making a setting for one groove insures that the other settings are correct, and is a much faster way of checking gage stability than was possible with a group of nine separate gages.

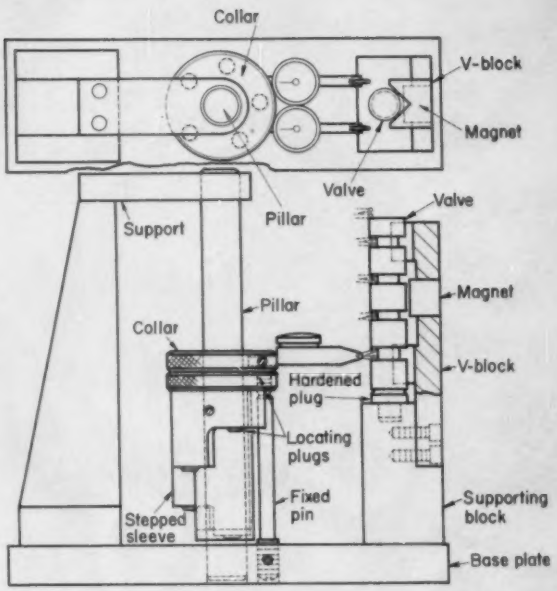


Fig. 2. Inspection fixture has gages mounted on a sleeve which rides up and down on a pillar. Spool type valve is held in a vertical V-block by a magnet and supported by a dimensionally accurate plug.

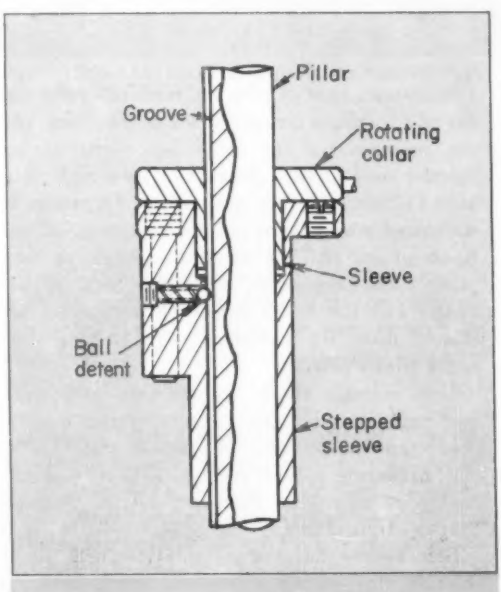
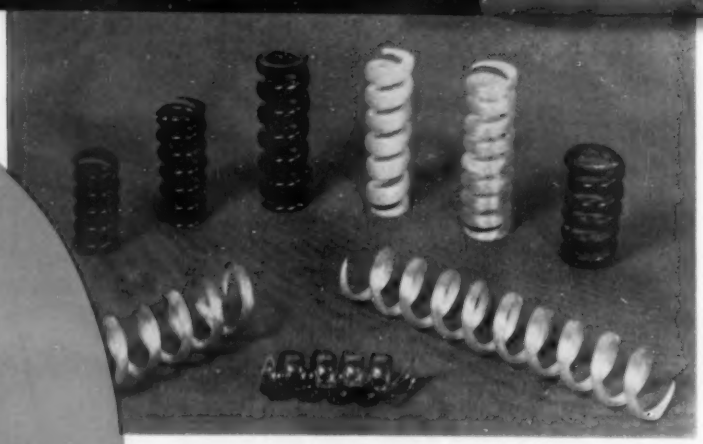


Fig. 3. Detail of sleeve and collar assembly.

forming **plastic springs**



Plastic springs can be produced in a variety of shapes, sizes and colors to meet specific design requirements.

SPRINGS made of plastics and rubbers have a number of advantages for specialized applications. They are nonmagnetic and have low electrical and thermal conductivity. Because of their high resistance to corrosion, they are suitable for use in installations where there are concentrations of acid fumes or salt air. The strength-to-weight ratios of plastics are often higher than those obtained with metals and the broad range of transparent and colored materials available makes striking decorative effects possible.

Until recently, plastic springs were infrequently used because no satisfactory technique for quantity production was available. A practical procedure for mass-producing springs from glass-fiber-reinforced resins has now been developed by the National Bureau of Standards.

Best results have been obtained with vinyl-chloride vinyl-acetate copolymer tubing having a $\frac{1}{4}$ or $\frac{3}{16}$-inch diameter and a $\frac{1}{8}$-inch wall thickness. Lengths of glass rovings are formed into a loose yarn, without twist, which is then doubled back to make a U-shaped bundle. This bundle is thoroughly soaked in liquid resin. A steel wire is pushed through the tubing, attached to the bend in the U-shaped bundle, and used to pull the bundle through the tubing. Considerable force is applied to the wire by means of a small windlass.

When tubing is completely filled, the wire is disconnected and the ends of the tubing are sealed with hose clamps. After forming and curing, the springs are cut and ground to finished length.

The most promising resins tested have been epoxies and polyesters. These resins are best suited for spring applications on the basis of torsional moduli, temperature sensitivity and ease of handling. In general, polyesters are more sensitive to elevated temperatures than epoxy resins, although epoxy materials vary widely in this respect.

Springs made from polyester resins with glass-fiber reinforcement show good energy recovery properties after short periods of storage at —40 F, but these properties are adversely affected by a 13-day exposure at 135 F while under stress. The most satisfactory results have been obtained with an epoxy resin cured with m-phenylenediamine. Springs made of this material have torsional moduli of rigidity of approximately 1.0×10^6 psi. In two-inch lengths they deflect $\frac{1}{2}$ inch under a static load of 25 lb. Three-inch springs of the same type have retained 40 percent of their original energy when stored at 135 F for 13 days under full compression.

When the glass-epoxy springs were tested for recoverable energy a second time, higher values were invariably obtained. This "work tempering" is characteristic of epoxy resins as has been demonstrated by torsion tests on nonreinforced plastic rods. An improvement of as much as 120 percent over the original available energy is indicated.

Mechanical and thermal properties of plastic springs can be varied widely by proper choice of materials and dimensions. Increasing the glass content, for example, will result in stiffer and more brittle springs.

Versatile Tooling Cuts Production Costs

in low-volume manufacture of printed circuits

By T. W. Black
Assistant Editor

Fig. 1. Holes in template (arrow) are duplicated in printed wiring board on turret punch press.

A number of different designs of printed wire circuit boards are produced on the same equipment at the GE Light Military Electronics Division. This is possible because versatile tooling is extensively employed. Assembly methods are also characterized by a high degree of flexibility.

THERE HAVE BEEN many spectacular applications of automation to high-volume production in American industry during the past ten years. Equal, if less spectacular, progress has been made in the development of efficient manufacturing methods where production volumes are so low that extensive application of automation requires special consideration and planning. This is the case at the Light Military Electronic Equipment Department of General Electric, which produces airborne radar sets and similar equipment at Utica, New York.

A wide variety of small electrical circuits are used in the end products of the plant. These consist of printed wiring boards to which components such as pulse transformers, resistors and capacitors are added to make up the complete assembly. Because of the relatively low-volume requirements for any one circuit design, the tool engineering problem has been to develop and apply efficient and flexible small-lot production methods. This problem has been solved by GE methods engineers through the use of versatile tooling and through simplified assembly methods.

Printed Wiring Board Production: First step in circuit manufacture is production of printed wiring boards. The boards, which form the chassis of the circuit and have an applied copper wiring pattern, are made of phenolic board approximately one-eighth inch thick. This material is received in large sheets which are sawed to correct manufacturing size. After cutting to size, two holes are pierced in the individual boards to facilitate location and handling during subsequent operations.

The next operation is to pierce holes into which components are inserted during assembly. Some

designs require piercing more than one hundred holes of several different sizes. For relatively large-volume production, piercing is accomplished by a special die in a standard punch press. An alternative method for low-volume production would be to drill the holes on a precision jig borer, with attendant use of highly skilled labor and inherently low production speeds. The latter method would be prohibitively costly.

Comparatively high production rates have been combined with the desired degree of flexibility through use of a Wiedemann turret punch press, *Fig.* 1, which duplicates perforations in a master template with the required degree of accuracy. Locating strips, slightly lower than the level of the press table, are used to align the template precisely. Manufacturing holes in the board insure proper alignment when it is clamped to the cross slide for punching. The cross slide travels from side to side on a cross bar which in turn travels from front to rear on trolley rails. Workpieces can thus be traversed to any desired position under the turret head.

In operation, a stylus mounted on the cross slide is positioned over the hole in the template which is to be reproduced in the workpiece. When the trigger on the pistol grip of the stylus is pulled, the stylus point enters the hole in the template. A microswitch trips the press automatically when the point has reached the desired depth in the template.

Cycle time of the press is 150 strokes per minute. While accurate positioning of the stylus point by the operator would appear at first glance to be a time-consuming operation, in actual practice operators have gained sufficient skill to pierce holes at high rates of speed, particularly when working on boards containing large numbers of closely spaced holes of the same size.

All holes of any one size are punched in succession and then the turret is rotated to bring the next size punch into position. The turret consists of an upper section, containing up to 20 punches, and a lower section, containing the corresponding dies. The punch and die sections rotate as a unit. Rotation of the turret is controlled by a handwheel at the front of the press. Locking pins engage index pinholes in the turret when the punch is in operating position. The press will not cycle unless the turret is locked in position. A foot treadle is depressed when it is desired to release the locking pins in order to free the turret for rotation. This safety feature, along with the automatic device to trip the press, prevents damage to the punch or

Fig. 2. (above) Spring-loaded punches are carried in removable holder. T-head of holder engages with T-slot in ram of press for punching.

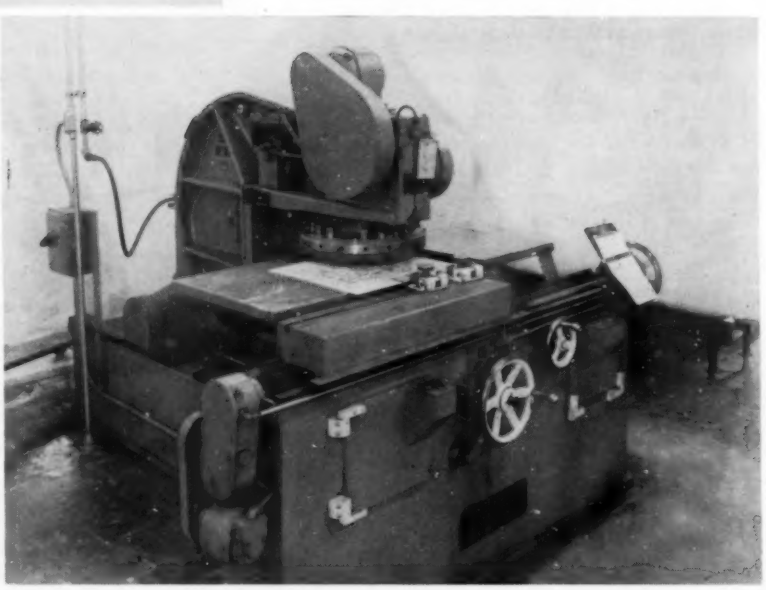


Fig. 3. (right) Turret punch press for making template has precision controls for accurate hole location.

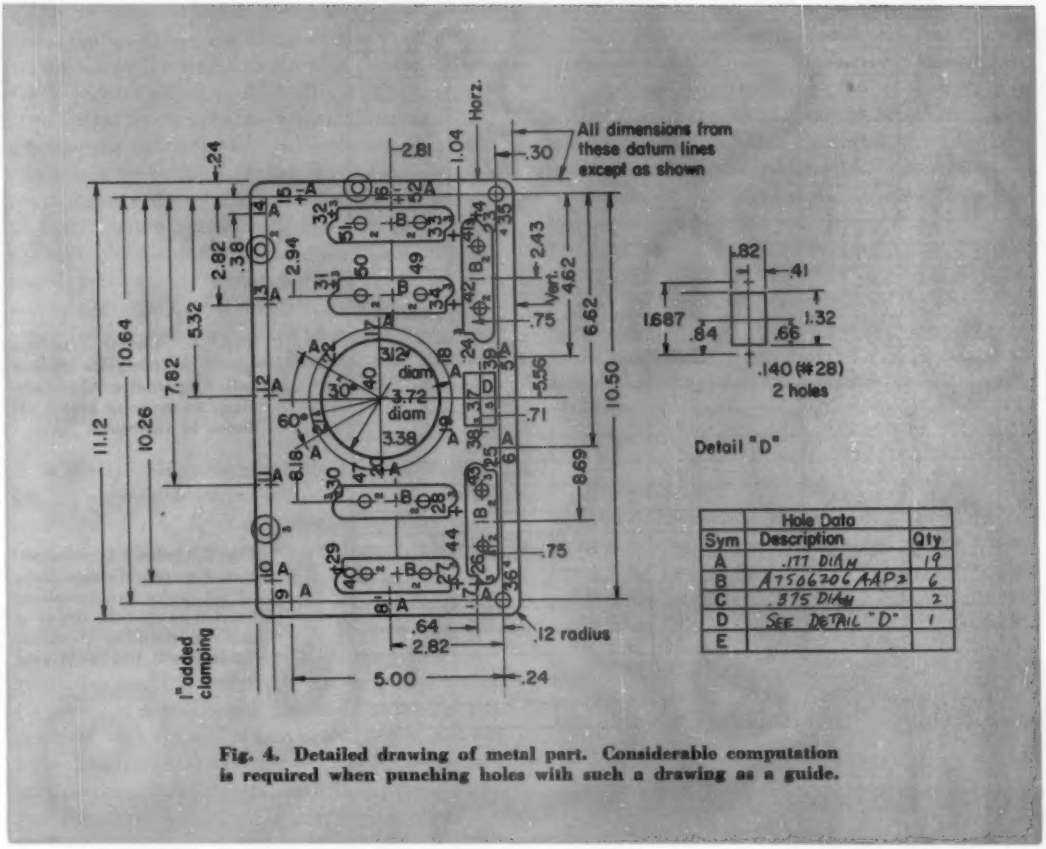
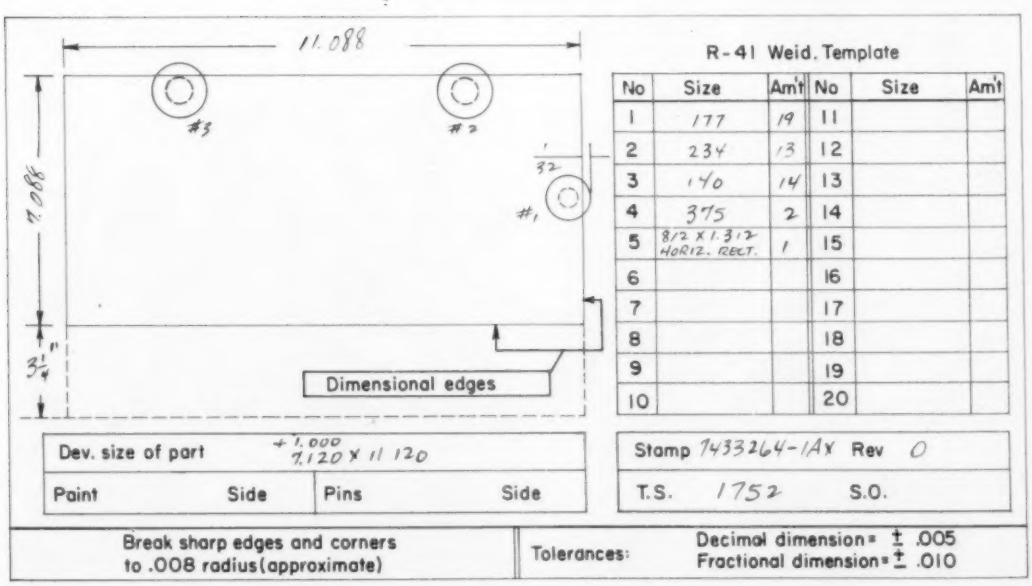


Fig. 4. Detailed drawing of metal part. Considerable computation is required when punching holes with such a drawing as a guide.

Fig. 5. Simplified sketch of template provides information necessary to trim template to size. Area shown by dotted lines is required to grip template during punching of holes and is subsequently cut off.


11.088
7.088
#3
#2
#1
3/32
3 1/4"
Dimensional edges
R-41 Weld. Template
No | Size | Am't | No | Size | Am't
1 | 177 | 19 | 11 | | |
2 | 234 | 13 | 12 | | |
3 | 140 | 14 | 13 | | |
4 | 375 | 2 | 14 | | |
5 | 8/2 X 1.312 HORIZ. RECT. | 1 | 15 | | |
6 | | | 16 | | |
7 | | | 17 | | |
8 | | | 18 | | |
9 | | | 19 | | |
10 | | | 20 | | |
Dev. size of part +1.000 7.120 x 11.120
Paint Side
Pins Side
Stamp 7433264-1AX Rev 0
T.S. 1752 S.O.
Break sharp edges and corners to .008 radius (approximate)
Tolerances:
Decimal dimension = ± .005
Fractional dimension = ± .010

Third Angle Projection

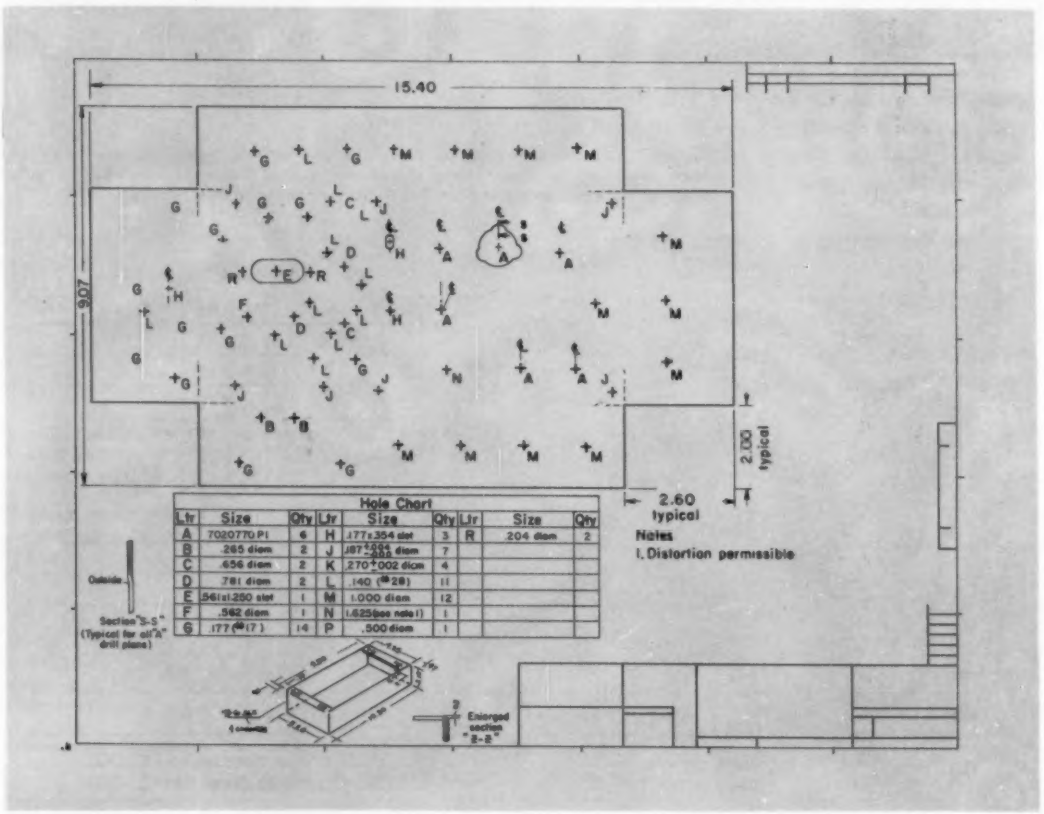
K—T.S. .1752

Hole Chart

No	Vertical	Horizontal	Size	No	Vertical	Horizontal	Size
1	3.500	.250	.189	28	1.458	8.410	.140
2	6.870	2.000	.189	29	4.162	9.850	
3	6.870	9.000	.189	30		7.950	
4	.880	.240	.177	31		2.710	
5	.240	4.260		32	4.162	.810	
6	.240	6.860		33	1.458	1.270	
7	.880	10.880		34	1.458	3.170	.140
8	3.060	10.880		35	.300	.310	.375
9	5.240	10.880		36	.300	10.810	.375
10	5.880	10.500		37	.710	5.560	8 x 2 x 3/8 HORIZONTAL SLOT
11		8.060		38	.710	6.400	.140
12		5.560		39	.710	4.713	.140
13		3.060		40	3.310	5.560	.234
14	5.880	.620		41	.758	1.680	
15	5.240	.240		42		3.180	
16	3.060	.240		43		7.940	
17	3.310	3.700		44	.758	9.440	
18	1.699	4.630		45	2.060	10.080	
19	1.699	6.490		46	3.560	10.080	
20	3.310	7.420		47	3.560	8.180	
21	4.921	6.490		48	2.060	8.180	
22	4.921	4.630	.177	49	2.060	2.940	
23	.520	1.078	.140	50	3.560	2.940	
24	.980	3.782		51	3.560	1.040	
25	.520	7.338		52	2.060	1.040	.234
26	.980	10.042					
27	1.458	10.310	.140				

Fig. 6. (left) Program given to template maker tells him what machine settings to make to punch all holes in template.

Fig. 7. (below) Dimensionless drawing. Center lines of all holes are precisely located so that the drawing can be used as a visual "template" for drilling holes.


15.40
9.07
2.00 typical
2.60 typical
Hole Chart
Ltr | Size | Qty | Ltr | Size | Qty | Ltr | Size | Qty
A | 7020770 Pl | 6 | H | .177±.354 slot | 3 | R | .204 diam | 2
B | .265 diam | 2 | J | .187 +.004 -.000 diam | 7
C | .656 diam | 2 | K | .270 +.002 -.000 diam | 4
D | .781 diam | 2 | L | .140 (⌀28) | 11
E | .561±1.250 slot | 1 | M | 1.000 diam | 12
F | .562 diam | 1 | N | 1.625(see note 1) | 1
G | .177 (⌀7) | 14 | P | .500 diam | 1
Notes
1. Distortion permissible
Outside
Section "S-S" (Typical for all "A" drill plans)
Enlarged section "2-2"

workpiece since the punch cannot descend until both it and the workpiece are in the correct position.

Punches are carried in removable punch holders, *Fig* 2, and are spring loaded. They do not protrude from the holder except when actually piercing. Thus, the stripper contacts the workpiece ahead of the punch and the spring pulls the punch back through the stripper on the return stroke. An unusual feature of the punching operation is that the punch does not enter the die, the characteristics of the phenolic board making this unnecessary. T-heads on the punches engage a T-slot in the ram of the press when the punches are indexed to piercing position, making ram and holder an integral unit. Punches and dies can be quickly removed and replaced when necessary.

Template Manufacture: Metal templates used for the piercing operation are produced on a turret punch press, *Fig.* 3, of different design than those used for piercing printed wiring boards. Controls are similar to those commonly found on jig borers. Holes can be accurately located to plus or minus 0.002 inch in sheets up to 24 by 36 inches in size. In operation, the workpiece is clamped to a slide which is moved to left and right under the punch by means of a feed screw. The head of the press is mounted on ways and is also positioned in and out by a feed screw. Thus, to position the workpiece with respect to the punch, both the workpiece and the punch are moved. Feed screws are power operated to facilitate rapid alignment of punch and workpiece when holes some distance apart are pierced successively, thus conserving time.

Final positioning of the workpiece can be controlled by 12-inch diam handwheels. Dials graduated for 0.001-inch readings aid in making final settings. As many as 18 punches of different sizes can be accommodated in the turret head. Rotation of the head is controlled by a handwheel.

In order to expedite template making operations the amount of detailed calculation required of the operator has been reduced to a minimum. Detailed drawings, *Fig.* 4, are converted to simplified form, *Fig.* 5. The simplified drawings show the dimensions of the template and the number and sizes of holes to be pierced. A "hole chart," *Fig.* 6, serves as an instruction sheet for the operator, specifying the sequence of piercing operations and the correct machine settings for each hole.

Dimensionless Drawings: An alternative method of producing templates or "one-of-a-kind" printed wiring boards is currently under development. The new method has the advantage of eliminating the necessity for detailed drawings by sub-

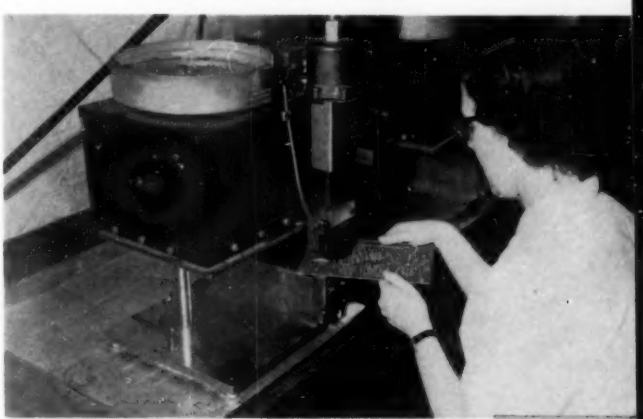


Fig. 8. (right) Air press for insertion of pins in printed wiring boards.

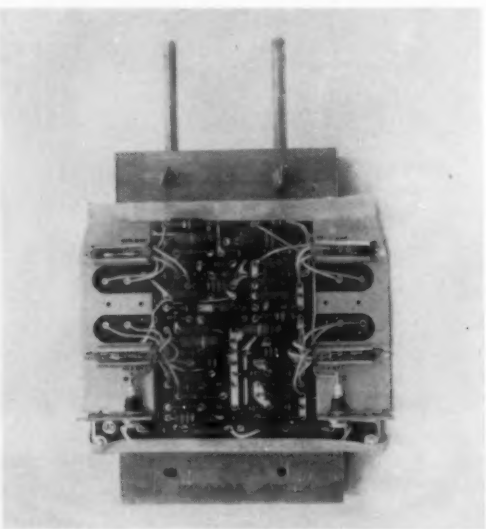
Fig. 9. (below) Components from numbered compartments in rotary bin are assembled to board in accordance with simplified diagram to left of operator.

stituting a "dimensionless drawing," *Fig.* 7. On the dimensionless drawing, center lines for all holes are located with extreme accuracy by the draftsman. Hole sizes are specified by an alphabetical letter referenced to a "hole chart" on the drawing.

The drawing is then reproduced on a dimensionally stable photographic film which serves as a master for drilling holes in a template or board. A special machine is being designed by GE methods engineers for the drilling operation.

With the drilling device under consideration no computation on the part of the operator will be required; he will simply follow the hole pattern indicated on the dimensionless drawing.

Assembly Operations: First operation in the assembly area is insertion of pins or eyelets in the holes in the board. This is accomplished on several small air presses, *Fig.* 8. Inserts are fed into position in the die automatically by means of a vibratory feeder and the board is positioned under the die by the operator for each insertion.



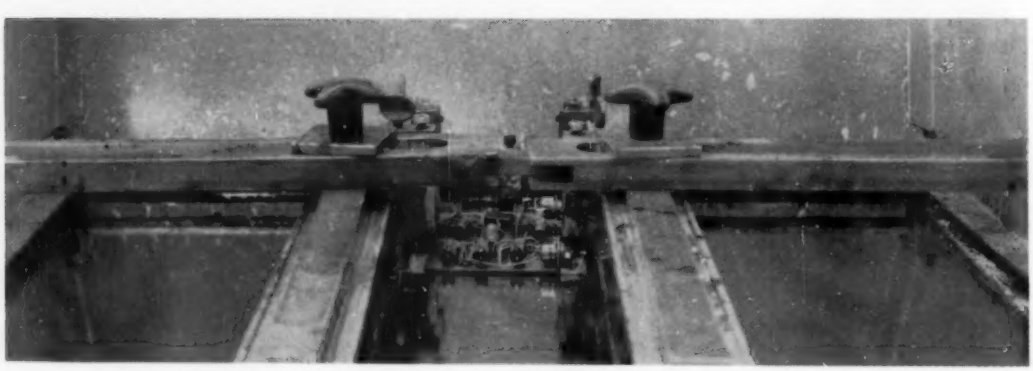
Final assembly operations, in which electrical components are inserted into the board, are manual. Operations are performed progressively on a long table, with each operator performing several operations on individual boards, which are then passed to the next operator. Breaking down the assembly work into separate operations in this fashion makes it possible for each employee to develop skill by performing only a small series of related operations, and it greatly simplifies storage of components at the work place during assembly.

Components for each circuit design are kept in individual rotary type bins, *Fig.* 9. All compartments in the bin are numbered and contain only one type of component. A simplified diagram of the circuit is made up for each station. Each diagram shows only the identification numbers and positions of components to be inserted at one station. Component identification numbers correspond to numbers of compartments in the rotary bin. This system effectively minimizes the possibility of getting components mixed up during assembly and eliminates errors resulting from misreading of complicated engineering drawings. Rotary bins for each circuit design are stored and filled in a stock crib and are brought to the assembly location only when required.

Following assembly of components to the printed board, circuits are transferred to the soldering operation. An assembled circuit, ready for soldering, is shown as *Fig.* 10. In soldering, the circuits are dipped into a tank of molten solder so that solder is picked up on all projecting leads and terminals on the bottom of the board. This is accomplished in a special tank, *Fig.* 11, in which the molten solder is raised by an "elevator" mechanism and all joints on the board are soldered. Inspection and testing operations complete the manufacture of the circuits.

Fig. 10. (left) Completed circuit on assembly fixture, ready for dip soldering.

Fig. 11 (below) Circuit in dip soldering tank.



Hot-Work Tool Steels:

applications, compositions, heat treatment

STEELS USED to construct hot-forging, forming, extrusion and die-casting dies are generally referred to as hot-work tool steels. Hot-forging, forming and extrusion of metals in the solid state are accomplished with both ferrous and nonferrous materials. Metals are also molded in the plastic state, a method largely confined to pressure die casting of brass. Molding of molten metals is usually limited to pressure and static die casting of zinc, magnesium, aluminum and aluminum bronze.

For maximum service life hot-work tool steels must be of sufficient toughness to resist working stresses. Compositions and heat treatments must enable the steels to resist softening and fire checking when in use. Wear resistance, too, must be adequate to assure normal and economical die life.

To meet these requirements, varieties of hot-work tool steels have been developed, each especially suited for specific types of applications. The data contained in this reference sheet will materially assist die designers in selecting hot-work tool steels with the characteristics desired for given jobs.

It should be noted that the problem of obtaining optimum die life does not end with the selection of the proper hot-work tool steel. As in any production job, mechanical factors affect performance. In forging, for instance, tools and dies should be correctly lined up and forging machines should be true so that pressure or impact is uniformly distributed. For the same reason, dies should not be mounted in worn or warped shoes or holders. To prevent excessive pressure from being developed on die faces, dies used in forging machines should be carefully adjusted, thus decreasing the possibility of fatigue failures.

Adequate preheating and cooling are also necessary. Well-warmed dies are less susceptible to cracking than cold dies. Keeping dies warm during periods of prolonged down time should not be overlooked. It will prolong die life.

Proper cooling retards localized overheating, which may exert a tempering or softening action on a die. Air cooling is the least drastic method and is suitable for all types of tools. A blast of air also serves to blow away loose scale, which, if left in place, shortens die life. Oil cooling is somewhat more rapid and severe than air cooling, but it rarely has any detrimental effects on a die.

Water cooling is the most effective method; however, it is drastic and dangerous with highly alloyed tungsten steels. Heat checking or cracking may result when large punches and dies are water cooled. Small punches and dies, on the other hand, are often successfully cooled with an ample flow of water.

Friction and sticking have adverse effects on die life. For best life, heavy graphite-bearing greases should be used to provide lubrication and prevent sticking. Heat-treating scale, if not excessive or combined with carburization or decarburization, should be left on tools and dies. This type of surface is extremely resistant to abrasion and holds lubricant, usually promoting better wear. Ground and polished tools will often gall or seize. If grinding and polishing are necessary, tools and dies should be oxidized at a temperature just below the tempering temperature to form a protective coating.

Recommended compositions, heat treatments and hardnesses for dies used in the hot forging, forming and extrusion of ferrous metals are shown in TABLES 1 through 10. A list of these dies and their uses follows:

FLAT DIES are used in beam, steam or air hammers to make disks, rings, blocks, flat bars and shapes.

Data furnished through the courtesy of H. E. Replogle, Universal-Cyclops Steel Corp., Bridgeville, Pa.

MACHINED OR CUT DIES operate in steam, air and board drop forging hammers.

FLAT AND SWAGING DIES are utilized to make large shafts, bars, blocks and special shapes in hydraulic presses.

DROP FORGING DIE INSERTS can be used to form an entire forging or as small sections set into a die block to give added strength or increased wear resistance at critical points.

VALVE EXTRUSION DIES, as the name implies, are designed for the manufacture of automotive and aircraft valves.

PRELOADED PRESS DIES are for the production of miscellaneous forgings in quick-acting forging presses. Inserts for such dies are shrunk in alloy-steel holders. The diameter of the holder should be 2½ to 3 times the diameter of the insert. Inserts should be 0.003 to 0.012 inch larger than the hole in the holder. High-alloy tungsten type inserts with high hardnesses can be used with preloaded dies, giving longer die life.

HOT-FORGING MACHINE (UPSETTER) TOOLS include gripper and header dies. In gripper dies, two grippers—one stationary and one moving—grasp the stock and permit the header die to upset the metal into a cavity at the end of the grippers. Many gripper dies are made with four grooves to facilitate the manufacture of bolts, spikes and similar parts on both hand-fed and automatic machines. Dies used on automatic machines are more susceptible to fatigue failures than those used on hand-fed machines and require steels with inherently tougher compositions. The hot stock extending beyond the gripper dies is "headed up" or upset by header dies.

INSERT DIES make solid bar and tubular upsets in one to five progressive positions to form finished forgings.

HOT-TRIMMER DIES trim the flash from forgings.

RIVET SETS are used in hot-heading rivets in boiler work, ship building, structural steel erection and general fabrication.

Data on hot-work steels for aluminum, magnesium and zinc die-casting dies are given in TABLES 11, 12 and 13. All of these dies are used in pressure casting. TABLE 14 contains information on die compositions for pressure casting of brass. Further data on hot-work tool steels will be contained in a future reference sheet.

Table 1—Flat Dies

Composition						Heat Treatment				Hardness
C	Mn	Ni	Cr	V	Mo	Preheat (F)	High Heat (F)	Quench Medium	Draw (F)	Brinell (No.)
0.60	0.70	—	—	—	—	1200	1450	Water	500/700	350/500
0.70	0.30	—	—	0.20	—	1200	1500	Water	500/700	350/500

Table 2—Machined or Cut Dies

Composition						Heat Treatment				Hardness
C	Mn	Ni	Cr	V	Mo	Preheat (F)	High Heat (F)	Quench Medium	Draw (F)	Brinell (No.)
0.60	0.70	1.50	1.00	—	—	1200	1500	Oil	600/1100	350/525
0.60	0.70	—	0.90	—	0.20	1200	1500	Oil	600/1100	350/525
0.60	0.80	1.50	0.75	—	0.25	1200	1500	Oil	600/1100	350/525
0.60	0.70	—	1.15	0.15	0.50	1200	1550	Oil	600/1100	350/525
0.60	0.60	1.75	0.90	—	0.70	1200	1550	Oil	600/1100	350/525

Table 3—Flat and Swaging Dies

Composition						Heat Treatment				Hardness
C	Mn	Ni	Cr	V	Mo	Preheat (F)	High Heat (F)	Quench Medium	Draw (F)	Brinell (No.)
0.60	0.70	—	—	—	—	1200	1450	Water	500/700	350/500
0.70	0.30	—	—	0.20	—	1200	1500	Water	500/700	350/500
0.60	0.70	1.50	1.00	—	—	1200	1500	Oil	600/1100	350/525
0.60	0.70	—	0.90	—	0.20	1200	1500	Oil	600/1100	350/525
0.60	0.80	1.50	0.75	—	0.25	1200	1500	Oil	600/1100	350/525
0.60	0.70	—	1.15	0.15	0.50	1200	1550	Oil	600/1100	350/525
0.60	0.60	1.75	0.90	—	0.70	1200	1550	Oil	600/1100	350/525

Table 4—Drop Forging Die Inserts

Composition								Heat Treatment				Hardness
C	Mn	Si	Cr	V	W	Mo	Ni	Preheat (F)	High Heat (F)	Quench Medium	Draw (F)	Brinell (No.)
0.50	0.30	1.10	1.75	0.25	2.50	0.50	—	1400	1750	Oil	1200	400/450
0.35	0.45	1.00	5.00	0.45	—	1.40	—	1400	1800	Air	1100	400/450
0.35	0.35	1.00	5.00	—	1.35	1.70	—	1400	1800	Air	1100	400/450
0.30	0.30	0.15	1.50	0.20	—	1.00	5.00	1300	1600	Oil	1100	400/490
0.80	0.70	0.35	5.25	0.25	—	1.15	—	1400	1800	Air	1150	400/450*
1.00	0.70	0.35	5.25	0.25	—	1.15	—	1400	1800	Air	1175	400/450*
0.30	0.25	0.35	3.25	0.30	9.00	—	—	1450	2150	Oil & Air	1200	400/450
0.40	0.30	0.35	3.25	0.40	11.00	—	—	1550	2150	Oil & Air	1225	400/450
0.45	0.30	0.35	3.50	0.50	15.00	—	—	1550	2200	Oil & Air	1275	400/450
0.50	0.30	0.35	4.00	1.00	18.00	—	—	1550	2200	Oil & Air	1275	400/450

* Specialized applications involving relatively shallow, simple impressions. Inserts are shrunk into a die block or keyed into a holder. Fits should be accurate and great care exercised to make sure of 100 percent seating when used in a holder. Ground surfaces are recommended.

Table 5—Valve Extrusion Dies

Composition						Heat Treatment				Hardness
C	Mn	Si	Cr	V	W	Preheat (F)	High Heat (F)	Quench Medium	Draw (F)	Brinell (No.)
0.60	0.30	0.30	3.75	0.65	15.00	1550	2200	Oil & Air	1225	460/525
0.30	0.25	0.35	3.25	0.30	9.00	1450	2150	Oil & Air	1150	460/525
0.35	0.30	0.35	3.25	1.00	11.00	1450	2150	Oil & Air	1150	460/525
0.55	0.30	0.35	4.00	1.00	18.00	1450	2325	Oil & Air	1100	495/555

Table 6—Preloaded Press Dies

Composition						Heat Treatment				Hardness
C	Mn	Si	Cr	V	W	Preheat (F)	High Heat (F)	Quench Medium	Draw (F)	Brinell (No.)
0.40	0.30	0.35	3.25	0.40	11.00	1550	2150	Oil & Air	1100	540/580
0.45	0.30	0.35	3.50	0.50	15.00	1550	2200	Oil & Air	1150	540/580

Table 7—Gripper and Header Dies

Composition								Heat Treatment				Hardness
C	Mn	Si	Ni	Cr	V	W	Mo	Preheat (F)	High Heat (F)	Quench Medium	Draw (F)	Brinell (No.)
0.60	0.80	—	1.50	0.75	—	—	0.25	1200	1500	Oil	600/1100	350/525*
0.95	0.30	0.30	—	4.25	0.50	—	0.40	1450	1800	Air Blast	600/1100	350/525
0.50	0.30	1.10	—	1.75	0.25	2.50	0.50	1400	1750	Oil	600/1100	450/500
0.35	0.45	1.00	—	5.00	0.45	—	1.00	1400	1800	Air	600/1100	450/500
0.35	0.45	1.00	—	5.00	—	1.35	1.70	1400	1800	Air	600/1100	450/500
0.35	0.30	1.00	—	5.25	—	5.25	0.30	1400	1950	Air	1075	450/500
0.30	0.25	0.30	—	3.25	0.30	9.00	—	1400	2150	Air	1150	450/500
0.40	0.60	1.50	—	7.50	—	7.50	—	1550	2150	Oil & Air	1150	450/500

* This steel is usually purchased in the heat-treated condition, machined and put in service. Satisfactory for short runs but will not wear as well as more highly alloyed types.

Table 8—Insert Dies

Composition							Heat Treatment				Hardness
C	Mn	Si	Cr	V	W	Mo	Preheat (F)	High Heat (F)	Quench Medium	Draw (F)	Brinell (No.)
0.50	0.30	1.10	1.75	0.25	2.50	0.50	1400	1750	Oil	1200	400/450
0.35	0.45	1.00	5.00	0.45	—	1.40	1400	1800	Air	1100	400/450
0.35	0.45	1.00	5.00	—	1.35	1.70	1400	1800	Air	1100	400/450
0.35	0.30	1.00	5.25	—	5.25	0.30	1400	1950	Air	1175	400/450
0.30	0.25	0.30	3.25	0.30	9.00	—	1400	2150	Air	1200	400/450
0.40	0.60	1.50	7.50	—	7.50	—	1550	2150	Oil & Air	1200	400/450
0.25	0.25	0.30	2.75	0.25	15.00	—	1550	2350	Oil & Air	1200	400/450

Table 9—Hot Trimmer Dies

Composition							Heat Treatment				Hardness
C	Mn	Si	Cr	V	W	Mo	Preheat (F)	High Heat (F)	Quench Medium	Draw (F)	Brinell (No.)
0.50	0.30	1.10	1.75	0.25	2.50	0.50	1200	1750	Oil	1225	425/475
0.40	0.30	0.35	3.25	0.40	11.00	—	1500	2150	Air	1200	425/475
0.50	0.30	0.35	4.00	1.00	18.00	—	1550	2300	Air	1200	425/475

Table 10—Rivet Sets

Composition							Heat Treatment				Hardness
C	Mn	Si	Cr	V	W	Mo	Preheat (F)	High Heat (F)	Quench Medium	Draw (F)	Brinell (No.)
0.90	0.25	—	—	0.20	—	—	1100	1450	Water	600	555*
0.50	0.70	—	1.00	0.15	—	—	1100	1525	Water	400	555*
0.55	0.45	1.15	—	0.20	—	0.50	1100	1650	Oil	750	555

* Quenched with cup up

Table 11—Dies for Aluminum and Magnesium Die Casting

Composition							Heat Treatment				Hardness
C	Mn	Si	Cr	V	Mo	W	Preheat (F)	High Heat (F)	Quench Medium	Draw (F)	Brinell (No.)
0.35	0.45	1.00	5.00	1.00	1.40	—	—	1800	Air	1100	425/444
0.35	0.45	1.00	5.00	—	0.30	5.25	1400	1950	Air	1150	425/444

Table 12—Cores and Ejector Pins for Die Casting Dies

Composition						Heat Treatment				Hardness
C	Mn	Si	Cr	V	Mo	Preheat (F)	High Heat (F)	Quench Medium	Draw (F)	Brinell (No.)
0.35	0.45	1.00	5.00	0.45/1.00	1.40	1450	1800	Air	1100	425/475*
0.95	0.38	0.37	17.50	—	0.50	1450	1950	Oil	1050	425/475†

* Recommended for cores.
† Recommended for ejector pins.

Table 13—Dies for Zinc Die Casting

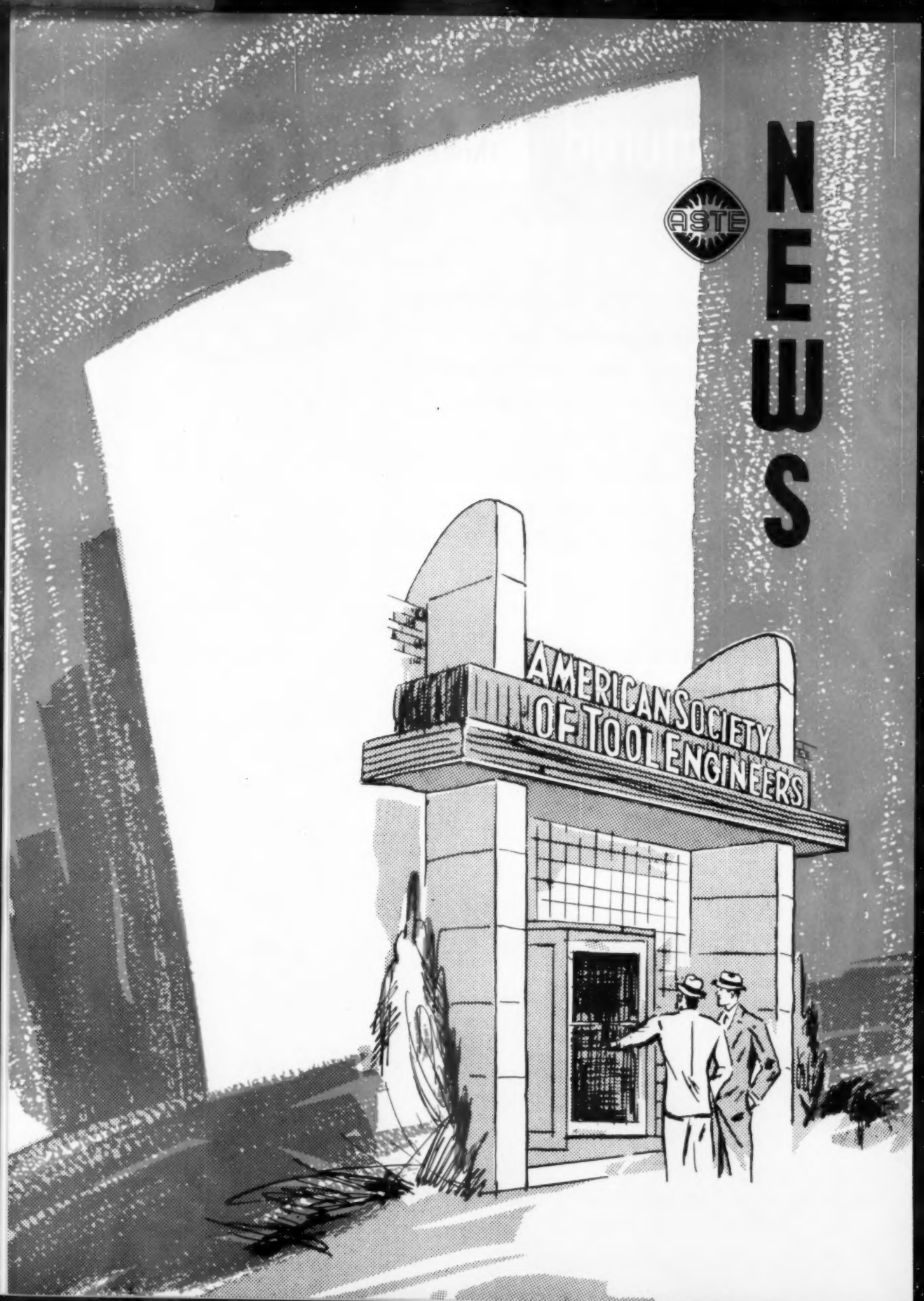
Composition						Heat Treatment				Hardness
C	Mn	Si	Cr	V	Mo	Preheat (F)	High Heat (F)	Quench Medium	Draw (F)	Brinell (No.)
0.40	0.40	—	—	—	—	Used in annealed condition				—
0.40	0.75	—	1.00	—	0.20	1200	1575	Oil	1300	225*
0.50	0.75	—	1.00	0.15	—	1200	1550	Oil	1300	225
0.35	0.45	1.00	5.00	1.00	1.40	1450	1800	Air	1100	425/475†

* Usually machined in the heat-treated condition.
† Used for long run dies for maximum life.

Table 14—Dies for Pressure Casting of Brass

Composition							Heat Treatment				Hardness
C	Mn	Si	Cr	V	W	Ni	Preheat (F)	High Heat (F)	Quench Medium	Draw (F)	Brinell (No.)
0.40	0.30	0.35	3.25	0.40	11.00	—	1550	2150	Air or Salt	1225	425
0.25	0.30	0.30	2.75	—	10.00	2.00	1550	2000	Air or Salt	1200	425
0.35	0.35	0.50	12.00	1.00	12.00	—	1550	2300	Air or Salt	1200	425

NEWS



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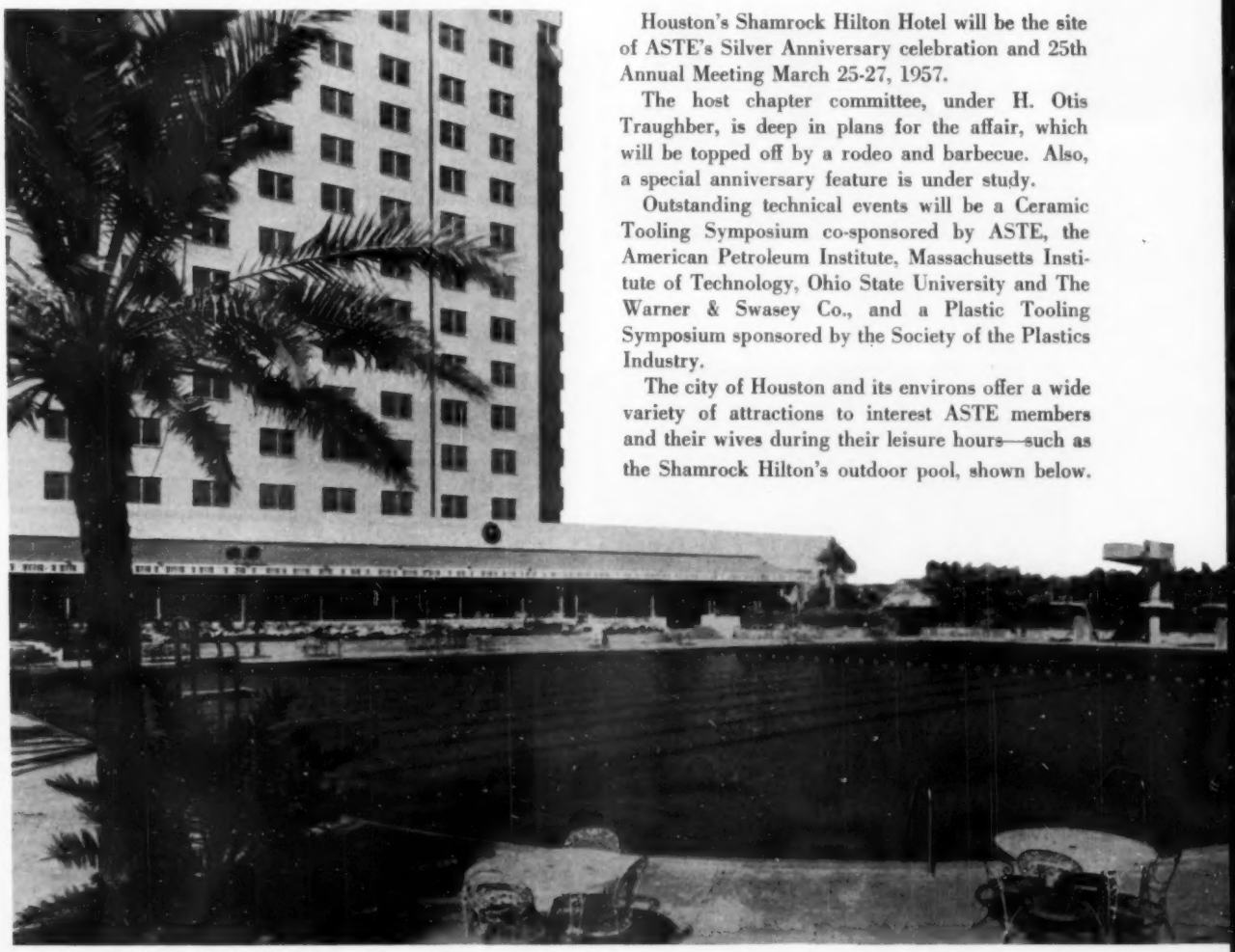
HOUSTON *host to* Silver Anniversary Meeting



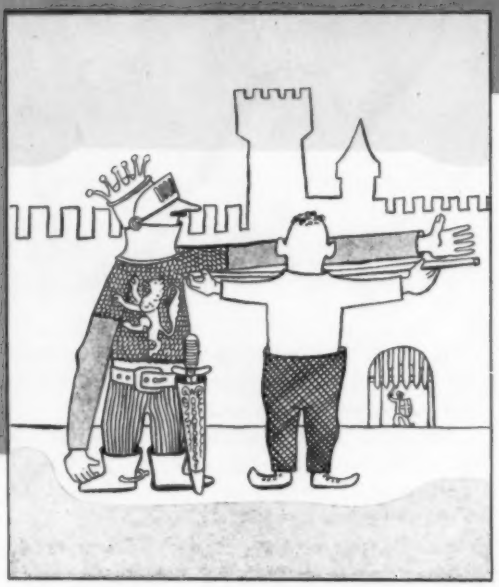
Houston's Shamrock Hilton Hotel will be the site of ASTE's Silver Anniversary celebration and 25th Annual Meeting March 25-27, 1957.

The host chapter committee, under H. Otis Traughber, is deep in plans for the affair, which will be topped off by a rodeo and barbecue. Also, a special anniversary feature is under study.

Outstanding technical events will be a Ceramic Tooling Symposium co-sponsored by ASTE, the American Petroleum Institute, Massachusetts Institute of Technology, Ohio State University and The Warner & Swasey Co., and a Plastic Tooling Symposium sponsored by the Society of the Plastics Industry.

The city of Houston and its environs offer a wide variety of attractions to interest ASTE members and their wives during their leisure hours—such as the Shamrock Hilton's outdoor pool, shown below.

what's doing in standards



Pictures courtesy of the American Standards Association.

The National Standards Committee is playing an increasingly important role in industries' vital standardization activities by coordinating the viewpoints of tool engineers from both the United States and Canada, and in recording the results of this work with other interested groups.

Valuable work is being done by ASTE chapter standards committees; to date the review of some 84 American Standards has been undertaken as a result of the increasing awareness of the value of standards in the field of manufacturing.

The ASTE National Standards Committee met with Cyril Ainsworth, technical director of the American Standards Association, in July, 1954, to find out how ASTE could take a more active part in national standards activities.

From this meeting emerged a program for reviewing and criticizing current American Standards with the idea of preventing the continued use of standards which are not acceptable in their present form to tool engineers.

The National Standards Committee established a broad structure of this program and maintains a liaison between the 35,000 ASTE members and the American Standards Association, as well as other organizations in the standards field. Each of the 139 ASTE chapters has its own counterpart of the National Standards Committee. These chapter standards committees form the backbone of the ASTE standards organization.

Heading the ASTE National Standards Committee for 1956-1957 is Chairman John E. Rotchford, regional manager of the Bay State Tap & Die Corp. of Mansfield, Mass. He is ably assisted by Vice Chairman Arthur E. Crom, tool engineer for Consolidated Vultee Aircraft in San Diego, Calif.; and ASTE Vice President George A. Goodwin, chief process engineer of the Master Electric Co. in Dayton, Ohio, who acts as ex-officio member of the committee.

Staff administrator is George M. Hargreaves and other members of the committee are: George F. Bryan, Truman Coy, Clyde L. Fanning, F. J.

review

Geoffroy, Louis Jensen, Paul Jones, Jr., George J. McLaughlin, Harry J. Moffatt, Joe Penn, Ralph I. Robbins, Dean F. Saurenman and Denis L. Swan.

ASTE itself is represented on several standardization organizations: the American Standards Association's Standards Council, Mechanical Standard Board, Graphic Standards Board, and the Canadian Standards Association.

Through its National Standards Committee, ASTE sponsors two ASA sectional committees, B-52, on "Classification of Materials for Tools, Gages and Fixtures," and B-67, on "Industrial Diamonds and Accessories for Their Use," and is a co-sponsor of Sectional Committee B-5 on "Small Tools and Machine Tool Elements."

One important phase of the ASTE standards program provides for analysis by chapter committees of existing standards. The National Standards Committee gathers their suggestions for improvements and forwards them to the responsible ASA sectional committees.

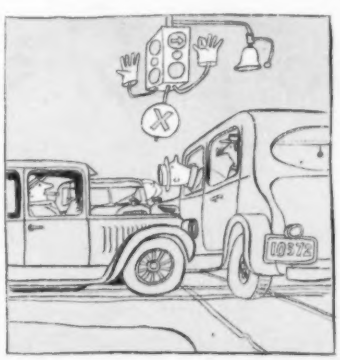
Toledo chapter is an outstanding example of what is being done by ASTE chapter standards committees. The chapter undertook a review of the American Standard B5.25-1950, Punch and Die sets. After careful study, Toledo made a final report with a number of recommendations. This report was forwarded to ASA's sectional committee B5, and presently forms the basis of a general reappraisal by that group.

On receiving the Toledo chapter standards committee's review, the sectional committee chairman appointed a new technical committee, under the leadership of an ASTE member, to review the subject of punch press tools completely. The technical committee is now engaged in this thorough review.

An additional program being carried on by ASTE's National Standards Committee is that of cooperation with interested groups in the investigation of original standards in such fields as optical tooling, jigs, fixtures and templates, piercing punches and die buttons, machine tool installation and self-powered units for drilling, tapping, boring and grinding.

Not all of the programs under the jurisdiction of the National Standards Committee, however, are directly related to the American Standards Association. One NSC subcommittee is currently preparing a manual on tool steel classification by end use (which will appear as Reference Sheets in THE TOOL ENGINEER). This manual is intended to serve as a guide to tool engineers, who are generally not metallurgists, in selecting AISI Tool Steel Grades for specific applications.

In cooperation with the Canadian Standards Association, a group of our Canadian chapter standards committees have undertaken a project to combine Joint Industry Conference Standards on hydraulic, pneumatic and electrical equipment for machine tools into a machine tool installation standard. The resulting standard will be made to concur with existing provincial and national electrical codes and should prove most useful to machine tool builders and Canadian manufacturers.



The Society's National Standards Committee and headquarters staff are very willing to answer questions or to give assistance to local chapters participating in the standards program. Send any questions to George M. Hargreaves, staff administrator, at national headquarters.

These members of Syracuse chapter's book committee have already carried out one National Book Committee project with great success. From left they are Jay Endres, Frank Ungleigh, chairman; and Robert Metz.

Society to publish 2 new handbooks

Approval by the ASTE Board of Directors of three new handbooks to be compiled and published by the Society's Book Department under the supervision of the National Book Committee brings to six the number of ASTE handbooks planned or already in print.

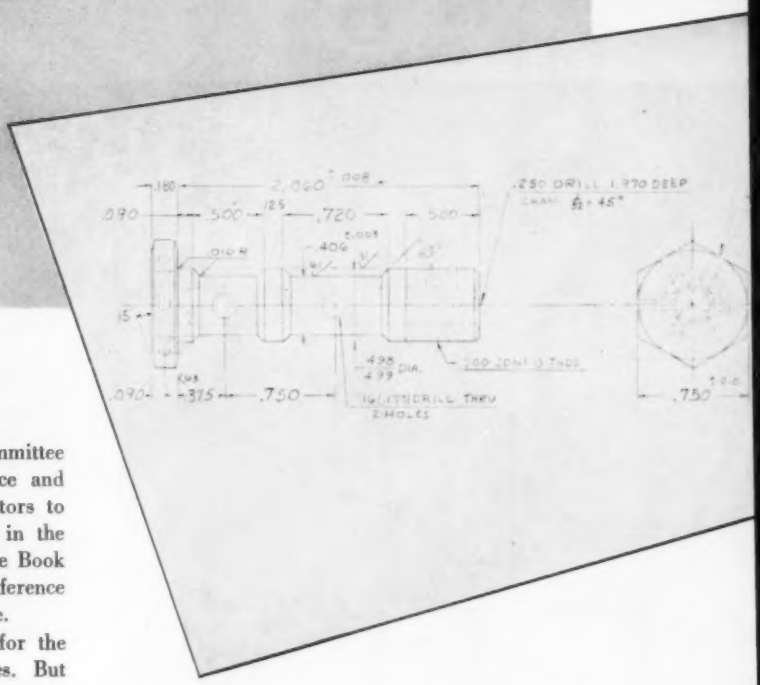
Authorized in August were *Planning and Tooling for Powder Metal Parts, Machining with Carbides and Oxides,* and *Jig and Fixture Design,* National Book Committee Chairman Francis J. Sehn reports. McGraw-Hill Book Co. is the publisher.

Previously authorized and now well under way is the *Handbook of Process Planning and Estimating.* Also, a new edition of the *Tool Engineers Handbook* is in progress.

The new handbooks are part of the Society's rapidly expanding book program which is extending to every one of its 139 chapters. Major projects have been assigned to 80 chapter book committees, with more assignments on the way, according to Technical Director Frank W. Wilson.

Several chapter book committees have already turned in excellent results on special projects. They are: Toledo, Rochester, Syracuse, Tri-Cities, Elmira, Binghamton, Indianapolis, Williamsport, Louisville, Atlanta, Mid-Hudson, Piedmont and Southeastern Massachusetts.

The Book Department needs help from all ASTE



This was the Syracuse committee's assignment: process planning for a stainless steel long nozzle screw.

members, however, not just chapter book committee members. It takes years and the assistance and fresh ideas of many hundreds of contributors to compile a good handbook. And the men in the field are the best source of material. So the Book Department urges all members to send in reference data they may have developed for possible use.

The handbooks are primarily designed for the men in the field, to refresh their memories. But they have proven equally valuable to college students and to young tool engineers working for promotion to the management level.

A dozen colleges and universities use the *Tool Engineers Handbook* as required reading. And in medium-sized or small companies without formal training programs the handbook is a training course in itself for the ambitious engineer, giving him the know-how he hasn't yet acquired by practical experience.

Planning and Tooling for Powder Metal Parts

Covering the "reincarnation" of a forming process dating back to the ancient Babylonians and Syrians, *Planning and Tooling for Powder Metal Parts* is also well under way. A practical treatise, it will be about 250 pages long.

The handbook will help the process planner evaluate the possibilities of the powder metal process compared with other processes. It will also give the best designs of dies for powder metallurgy, but will discuss the metallurgical aspect only briefly.

George A. De Groat of the National Book Committee is chairman of the steering committee.

Handbook of Process Planning and Estimating

Authorized in October, 1955, after many requests from process engineers and others, the *Handbook of Process Planning and Estimating* will expand four sections of the *Tool Engineers Handbook* into a 750 to 1000-page reference work.

Process planning is the core of fabricative manufacturing, and the handbook will give the science an intensive as well as extensive treatment. Compilation of data is well along, but new contributions are still requested.

Willis J. Potthoff, vice chairman of the National Book Committee, heads the steering committee in charge of the project. One of these committees is assigned to each book or major subsection to sift contributions and to set policies.

Machining with Carbides and Oxides

Another new field will be explored by the *Machining with Carbides and Oxides* handbook, scheduled to be about 350 to 400 pages long.

It will include the basic machining processes using the carbides and newer oxides.

The first reference book to treat ceramic tooling, it too is a result of the great demand from ASTE members for a reliable compilation of the fast-moving developments of the past five years.

Here especially the Book Department asks for members' suggestions on what the book should contain to meet their needs.

Richard Montanus, National Book Committee member, is chairman of the steering committee.

Jig and Fixture Design

Still in its early stages, *Jig and Fixture Design* will be a sequel and companion piece to the *Die Design Handbook.*

This book, intended to serve educational as well

The Tool Engineers Handbook is a welcome award to both students and faculty. Here, Long Beach Chairman R. E. Gariss presents a copy to Eaton O. Bemis, principal of Woodrow Wilson High School.

as reference needs, will run about 400 pages and go far beyond merely showing designs. Fresh material, such as process planning for workholding, will be included. It will show the thinking process of the planner from the time he gets the part to be manufactured through design and application.

Its steering committee is headed by David A. Schrom, of the National Book Committee.

Still More Plans

Sales of the Society's first handbook, the *Tool Engineers Handbook*, published in 1949, have passed the 75,000 mark. A second edition is "in the works" for the book whose first edition was the culmination of nine years of planning and preparation. However, Mr. Wilson reassured members that does not mean the first edition is no longer useful; its basic data is probably 80 percent accurate today, he stated.

Nearly 12,000 copies of the *Die Design Handbook*, which was begun in 1952 and published in August, 1955, were sold in the first 10 months, and it is now in its second printing.

The future holds still more activity for the National Book Committee and the Book Department, Chairman Sehn reports. New titles are constantly being considered for their value to members. He urges members to send the committee suggestions for new handbooks, together with the reasons they feel such a book would be valuable.

Semiannual Meeting at Greenbrier

On Oct. 25-26, 1956, the Board of Directors of the American Society of Tool Engineers will convene at The Greenbrier, White Sulphur Springs, West Virginia, for its semiannual meeting.

Major consideration will be given to discussion and approval of the 1956-57 budget.

This meeting, like all Board meetings, is open to members. Those desiring to attend are cordially invited to be present at any or all sessions.

Kokomo *joins society ranks*

James Linn, left, is congratulated by Carl Darger and E. A. Brown after his installation as first chairman of the newly created chapter.

ASTE's 137th chapter—Kokomo, Indiana—got off to a flying start August 2 with an enthusiastic assist from national officers, chairmen and past chairmen of neighboring chapters and management representatives of local industries.

James B. Linn of Haynes Stellite Div., Union Carbide, was installed as chairman of the 120-member chapter.

Serving with him are Kenneth Runstadtler of Chrysler Corp., first vice chairman; Harry Moss of Delco Radio Div., General Motors Corp., second vice chairman; Eric Shone of Haynes Stellite, secretary; and Edward Roesener of Demaree Molder Plastics, Inc., treasurer.

The national ASTE family was also represented by Andrew B. Clark, director; Verne Loeppert, Membership Committee chairman; Carl Darger, Membership Committee area captain; Joe Penn, Standards Committee; and Marvin Bunting, staff administrator.

Indiana State Senator Richard Ellis, Kokomo attorney, was toastmaster for the occasion, and guests were present from Indiana ASTE Council, Kokomo Chamber of Commerce and Foremen's Club, as well as Fort Wayne, Chicago, South Bend, Muncie, Indianapolis and Evansville chapters.

President Howard C. McMillen, far right, swears in new Kokomo officers. From left they are: Eric Shone, Edward Roesener, Harry Moss, Kenneth Runstadtler and Chairman Linn. Mr. McMillen also spoke to the 150 members and guests on "The Responsibilities of the Tool Engineer."

Members of the 1956-57 National Constitution and Bylaws Committee met in Chicago August 25. From left they are: Roy O. White, Arthur Cervenka, Chairman Vincent M. Spahr, Staff Administrator Marvin Bunting, National Vice President H. Dale Long, and Melvin G. Burdett. Irwin F. Holland, parliamentarian and past national president, was not present.

Have You Entered the Gadgets Contest?

Got a gadget? Send it in to the Gadgets Contest TODAY! Your idea may be a winner!

Gadgets should be mailed to the Gadgets Contest Editor, THE TOOL ENGINEER, 10700 Puritan Ave., Detroit 38, Mich.

What is a "gadget"? A gadget is a tool or method developed to solve a specific production problem. It should contain a useful idea or an ingenious solution to a tool engineering problem.

Enter NOW—the contest is open to all members of ASTE.

LONG BEACH—Discussing the assignment on "The Tooling for Aircraft Manufacture" section of the forthcoming "Handbook of Process Planning and Estimating" are, seated left to right: John D. Sprinkle, book committee chairman; George F. Adams, National Book Committee; Frank W. Wilson, technical director of ASTE. Standing from left are: Raymond E. Gariss, chairman; and Charles W. Ward, second vice chairman. In August, 400 members met at The Petroleum Club for the annual fund raising social. *—Daniel B. Welty.*

Pittsburgh to Sponsor Educational Series On Tool Steel

"Tool Steels" will be the topic of Pittsburgh chapter's second annual educational series to be held in October and November at Carnegie Institute.

Sponsored in cooperation with the tool steel manufacturers, the series of five lectures, plus a final "Stump the Experts!" session, will open at 7:30 p.m. Monday, Oct. 1, with "Introduction to Tool Steel" by Allegheny Ludlum Steel Corp. and Firth Sterling, Inc.

"Cutting Tools" will be discussed at the second session on Oct. 8 by Vanadium-Alloys Steel Co. and Latrobe Steel Co. On the third Monday, Oct. 15, Bethlehem Steel Co. and The Carpenter Steel Co. will cover "Punch Press Tools."

The fourth lecture on Oct. 22 will see Universal-Cyclops Steel Corp. and Braeburn Alloy Steel Corp. handle "Hot Work Tools," while "Cold Work Tools" will be discussed by Crucible Steel Co. and Vulcan Crucible Steel Co. on Oct. 29.

"Students" attending the sessions are urged to "Bring Your Questions" at the final meeting Nov. 2, when certificates will be presented. This event will start with dinner at 6:30 p.m., followed by the meeting at 8 p.m.

Registration fee for the series is $2 for members, $5 for nonmembers. Those wishing to attend should contact E. Clinton Newman, 8280 Tanglewood Rd., Allison Park, Pa.

Obituaries

Stuart Anstey of Philadelphia chapter, branch manager of Danly Machine Specialties.

Carl W. Bearstler of Schuylkill Valley chapter, senior draftsman with Sander and Thomas, Inc.

Charles B. Cook of Hartford chapter, retired.

A. P. Gwiazdowski of Detroit chapter, professor at Tri-State College, Angola, Ind.

John L. McElroy of Chicago chapter, tool engineer with Mall Tool Co.

John B. Prusheik of Milwaukee chapter, owner of South Side Die and Tool Co.

John W. Ramey of Louisville chapter, owner of Ramey's Time Service.

Sigurd B. Swanson of Fairfield County chapter, president of Apex Tool Co., Inc.

HOUSTON—Shown at Houston chapter's annual picnic are, left to right: Chairman John D. Bailleres; W. H. Lloyd, picnic host; and Irvin Haddon.

North Texas Goes Record Distance for Plant Tour

A record for the greatest distance traveled for a technical plant tour was probably set by North Texas chapter in August.

Sixty-four members and guests boarded chartered buses in Fort Worth and Dallas on August 17 and headed for the Dow Chemical Co. plant at Freeport on the Gulf of Mexico, 350 miles from chapter headquarters. Roger Hunt, chairman of the outside activities committee, handled all arrangements.

Although they didn't arrive in Freeport until 3 a.m. Saturday, the group was up bright and early for an orientation lecture and slide films on the magnesium process, followed by a tour of the chemicals and by-products process at Plant A.

Their visit to Plant B, which contained the magnesium process, began with a magnesium fire demonstration and continued with a tour through magnesium cells to the final operation of casting pure magnesium ingots.

The rest of the day was occupied with an open pit barbecue and seining, swimming and fishing on the Gulf. The group returned home on Sunday.

—Roy T. Parker

Picnic Outings Held At Memphis, Peoria, Racine

Three ASTE chapters had large turnouts for their annual August picnics.

Memphis families enjoyed their outing at Ellendale Lodge under the direction of Bob Hilliard, while Peoria held its outing at Miller Park. Racine, despite lack of cooperation by the weatherman, had its indoor picnic at Island Park under the leadership of Robert Heinrich and John Kellogg.

Mid-Hudson Co-Sponsors Many Educational Courses

Coordinating their activities with other technical societies in the area, Mid-Hudson chapter's education and professional engineering committees report that 11 educational courses are being offered this year to further educational opportunities in the area.

Taking part are ASQC, ASME, AIEE, New York State Association of Highway Engineers, New York State Professional Engineers, and the director of adult education at Arlington High School.

Being offered are: Practical Mathematics; Basic Quality Control; Basic Engineering 1; Basic Engineering 4; Basic English 7; Professional Engineering Refresher Course Parts 1 and 2; Electronics Technician Course Part 1 —Basic Electricity; Part 3—Electric Circuits; Tool Design; Industrial Supervision; and Process Engineering.

ASTE members of the committee in charge are S. Cook, H. J. DePew, H. Keller, C. M. Newbury, F. Racine and H. J. Tesmer.

High school winners of *Tool Engineers Handbooks* have been announced by Education Committee Chairman Harold Depew. They are: Michael Fachter, Arlington; William Wanser, Poughkeepsie; Donald Heim, Hyde Park Central; and Donald Oliver, Wappingers Falls.

The chapter also arranged for each of these high schools to receive THE TOOL ENGINEER for a year.

A dinner for Mid-Hudson's treasurer, C. Morgan Newbury, who is moving to Hartford, was held on August 15. An active member of Mid-Hudson for six years, he was honored by his fellow members and also members of other societies. *—Attila G. V. de Illy*

A letter to all ASTE members

ASTE MEMBERSHIP HEALTH & ACCIDENT INSURANCE

The entire membership of the Society is being offered a "Health and Accident Insurance Policy" which has exceptionally good coverage at a remarkably low premium.

This insurance is being offered by the Continental Casualty Company and does not require any financial participation by the chapters or the headquarters office. The Insurance Company, through its Detroit broker, is absorbing all sales, promotion and administrative expenses. Neither the chapters nor headquarters derive any income from the sale of this insurance to our members. Every effort has been made to offer the best possible coverage at the absolute minimum price to the individual member. Some members now carrying similar insurance on their own tell us that the ASTE policy has broader coverage at 50 percent less cost than the individual policies they now carry.

Because of the large number of members involved and the type of work they do, the Insurance Company is in a position to offer us a similar policy that is available to medical and other professional groups.

If you have need for this type of insurance, we suggest you check what's available to you. We are confident you will agree that your ASTE membership has a real plus value to you.

Harry E. Conrad
Executive Secretary

members on the MOVE

Edward J. Shages of Hartford chapter has been named vice president and manager of the cutting tool and gage divisions of Pratt & Whitney Co., Inc.

Dr. Wililam E. Mahin, a member of the National Research Fund Committee, has been appointed executive secretary of the Committee on Manpower for the Metallurgy and Ceramics Professions by the American Society for Metals.

Richard F. Howe, Hartford, has been named supervisor of experimental manufacturing for the Research and Advanced Development Division of Avco Manufacturing Corp.

Waldemar Naujoks, member of Lansing chapter and the National Book Committee, has joined Kropp Forge Co. as manager of engineering.

Donald R. Chew of Mansfield chapter has been appointed to head quality control at Ohio Seamless Tube Div. of Copperweld Steel Co., Shelby, Ohio.

Ben A. Fleury, Jr., Chicago chapter, has been named assistant sales manager of Union Twist Drill Co.

Douglas C. Cunningham of Indianapolis has joined Standard Gage Co., Inc. as sales manager.

E. W. Hendrickson, a transfer to Kalamazoo chapter from Fox River Valley, has been appointed executive vice president of HeaTube Corp, Allegan, Mich.

Ernest M. Seifert, former charter member of Potomac chapter, has been promoted to industrial manager of U. S. Naval Ordnance Plant, Forest Park, Ill. A past national director, he is now a Chicago member.

Cleveland's **S. R. Rosen,** chief engineer of the U. S. Automatic Corp., Amherst, Ohio, has received his third award from the Technical Papers Subcommittee of National Screw Machine Products Association.

Sidney A. Matthews of Philadelphia chapter has been named machine tool analyst for the Standard Pressed Steel Co.

Robert Thoren of Chicago has been appointed district manager for the Rockford, Ill. area of Vickers, Inc.

Charles B. Martin of Pittsburgh chapter has been appointed an abrasive engineer by Norton Co.

Hjalmar Lundquist, Los Angeles chapter, formerly chief design and tool engineer, is now engineering consultant after his recent retirement from full service with National Vulcanized Fibre Co., Wilmington, Del.

George Ullring, member of Cleveland chapter, has been appointed assistant sales manager of Allen Manufacturing Co., Hartford, Conn.

Joseph A. Oeming, Saginaw Valley chapter, is now sales manager of Wickes Machine Tool Div. of the Wickes Corp.

Two Houston members received appointments in Reed Roller Bit Co.: **C. H. Elliott** was named vice president of Cleco Air Tool Div. and **J. A. Grundy** is now vice president of manufacturing of the Oil Tool Div.

Robert P. Uhl of Dayton chapter has been appointed New York district manager of The Carpenter Steel Co.

Joseph A. Brust, Detroit chapter member since 1937, has been named chief engineer of Efficient Engineering Co., Inc. He was formerly vice president and general manager of Pioneer Engineering and Mfg. Co. of Virginia.

Mark K. Wallach, charter member of San Antonio, has established a new business in France, manufacturing automobile components: aluminum wood-rimmed steering wheels for racing and sports cars, small centrifugal superchargers.

Three Mansfield chapter members have received promotions at Westinghouse Electric Corp., Mansfield, Ohio Works: **J. Ward Ingraham,** chairman of Mansfield chapter, as manager of manufacturing planning; **Hugh Ferguson** as superintendent of the tool division; and **Eugene Funston** as supervisor of tool engineering.

C. Morgan Newbury, Mid-Hudson treasurer, of the DeLaval Separator Co., has been named sales manager of the Harrington Tool and Machine Co., Hartford, Conn.

Fritz A. Zaner, Ann Arbor area, has been appointed executive vice president in charge of manufacturing and engineering at the Micrometrical Mfg. Co.

ERIE—Pictured is the welcoming committee at Erie's picnic, from left to right: standing, Jack Wantz; David Stout; seated, Ernest Miller; David Schuler, chairman; Henry Sedler; and Charles Williams, treasurer. A fine time was had by the 135 members and guests, and activities ranging from horseshoes to baseball and shuffleboard whetted appetites for the delicious ox roast and other picnic food. —*Thomas G. Brown*

TUCSON—Guest speaker Clifford E. Commeford, left, vice president of Paul B. Slater Co. and representing Brush Electronics Co., is shown with Chairman John Oberteuffer. Mr. Commeford discussed new military standards, as well as the conversion of standards from root mean square to the newly adopted ASA standards.

Positions Wanted

SALES & SERVICE MFG. REP.—Offering 11 years industrial tool experience to leading cutting tool mfg. Have established accounts, Philadelphia area—150 mile radius. Close association with industrial distributors. Resume supplied upon request. Write to Box 090, News Dept., The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

REGISTERED ENGINEER—both electrical and industrial, desires position with machine tool manufacturer to help design engineers with automation work. Presently employed with engineering firm on complex control engineering work. Member ASTE Cleveland chapter since 1943. Write to Box 087, News Dept., The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

ENGINEER—Seeking new and interesting position in or based in general Detroit area that involves sales or sales liaison and general administration duties with executive capacity potential. Willing to work and will assume responsibility. Thirty years old and family man. Education includes M.E. degree and certificate in business management. Experience includes mainly sales engineering plus sales administration, office work and administration, general shopwork and warehouse management. Write to Box 089, News Dept., The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

Discuss Developments in Tool and Die Welding

San Diego chapter heard a discussion of new developments in the welding of tools and dies August 14.

Speaker was Jonathan Marden, western sales manager of Eutectic Welding Alloys Corp. —*R. S. Brandt*

Members of the National Editorial Committee pause in their tour of Wisconsin Cuneo Press to examine a Ludlow typesetter. Crowding closer for a better look are, from left: John W. Greve, editor of THE TOOL ENGINEER; Harold D. Sullivan; Leo P. Tarasov; Harold W. Hagle; Donald E. Zierk; Einar Paulson, operator; George A. Goodwin, national vice president; and Committee Chairman G. Ben Berlien. The committee visited the plant, which prints THE TOOL ENGINEER, as part of its Aug. 10-11 meeting in Milwaukee. Absent were Joseph L. Petz and Donald E. Wernz.

Position Available

GAGE SALES ENGINEER—Qualified and aggressive young man wanted as sales representative for leading manufacturer of quality dial indicators and related gages. Process engineering, tool designing, quality control and inspection experience important. Progressive and expanding sales activity assures unlimited future advancement. Monthly salary, expense allowances and annual bonus provide ample incentive. Applications solicited for Chicago, Detroit and Newark, New Jersey areas. For further information send complete resume, starting salary required and area preference to Box 088, News Dept., The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

SANTA CLARA VALLEY — Thomas Hall, left, director of public relations and membership services of the California Manufacturers Assn., discussed the guaranteed annual wage in relation to supplemental unemployment benefits and showed a film "The Loaded Package." At right is William T. Wright, Santa Clara Valley chairman.

—*William H. Forbes*

KANSAS CITY—Shown behind the wheel of his award-winning car is Fred Patterson, who was sponsored by Kansas City chapter in the annual Soap Box Derby. Fred won the first two heats of the Class A event and the Class B race with a time of 34.9. Fred is the son of George M. Patterson, supervisor at the Kansas City Westinghouse Jet Engineer Plant and a member of ASTE for seven years. —*L. F. Alley*

New Color Movie For All Chapters

All chapters are now able to see "Tooling for Tomorrow," a 15-minute color movie of the ASTE Tool Show held last March in Chicago.

"Tooling for Tomorrow" is the first color movie ever to be photographed indoors using only "natural" lighting.

This process was so successful that headquarters has made reprints of the entire 15-minute movie available to all chapters.

Highlighting some of the major exhibits at the exposition, the movie pictures chapter members and delegates in action, and elections of a new ASTE president and national officers.

ASTE Co-Sponsors Engineering Conference At Illinois Institute of Technology

"New Horizons in Industry" is the theme of the sixth annual Illinois Tool Engineering Conference to be held at Illinois Institute of Technology in Chicago on November 2 and 3.

Sponsoring the event are: Illinois chapters of ASTE, Illinois Institute of Technology, Northwestern and Illinois universities.

At the opening session Friday evening representatives of management and labor wil give views on technological progress in industry.

Dr. H. B. Osborn, Jr., past president of ASTE and technical director of the Tocco Division of the Ohio Crankshaft Co., will present management's viewpoint, and P. L. Siemiller, general vice president, International Association of Machinists, will speak for labor.

Preceding their talks will be an address on "Research and Development for Industry" by Dr. Richard F. Humphreys, assistant director of Armour Research Foundation of IIT.

Welcoming the group the first day will be H. Dale Long, vice president of ASTE, and Dr. F. D. Carvin, director of the IIT mechanical engineering department.

The November 3 program, starting at 9 a. m., will feature panel discussions on "New Cutting Tool Materials" and "Economical Analysis in Machine Tool and Equipment Replacement."

The afternoon will be devoted to panel sessions on "New Developments in Extrusion Methods" and "Automation in the Metalworking Industry."

Howard C. McMillen, national president of ASTE, will speak at the luncheon program on "A Message from ASTE". Other talks will be given by S. E. Winston, dean of the Illinois Tech evening division, on "Educational Facilities for Tool Engineers" and Dr. Ralph G. Owens, IIT dean of engineering. Richard Miller, chairman of ASTE's Chicago chapter, will be toastmaster.

President John T. Rettaliata of Illinois Tech will address the conferees at dinner Saturday. Toastmaster will be Professor K. J. Trigger of the University of Illinois, a member of the National Education Committee.

Questions concerning the conference should be addressed to Professor Samuel E. Rusinoff, Mechanical Engineering Dept., IIT.

WICHITA—Representatives of five firms took part in a panel discussion on "Plastics in Manufacturing, Tooling and Production" recently. From left they are: John Rix, Cessna Aircraft Co.; Ralph Hart, chief engineer, Plastics Fabricating Co.; Wesley Mace, Boeing Airplane Co.; John McNally, Beech Aircraft Corp.; and standing, Moderator Wilbur Page, Tru-Scale Mfg. Co. *—Robert Gooden*

Oxide Tooling Discussed At Los Angeles

"Oxide Tooling of the Future" was the topic at Los Angeles chapter.

Delivering the technical address was Edward Kibbitt, Hartford chapter member and manager of field sale of tools, Stupakoff Div., The Carborundum Co. *—Gene Grahn*

Cemented Carbides Topic at Tucson

At the El Rio Country Club on July 10, 46 Tucson members heard Vincent Buerge, tool engineer for Wesson Co. of Detroit. Mr. Buerge spoke on the development and utilization of cemented carbides in tooling and production methods. *—C. J. Doubek*

Louis Polk of Dayton chapter presents an Eli Whitney musket to Sir James Mann, right, Britain's Master of the Armouries in the Tower of London.

Louis Polk Gives Yankee Musket to London Tower

Dayton chapter's Louis Polk, member of ASTE's Research Fund Committee and president of the Sheffield Corp., on June 27, presented the Tower of London Armouries with an Eli Whitney musket, which now occupies a place of honor in Britain's 10-centuries old national armouries collection.

This historic American weapon from Polk's personal collection, which was used in the War of 1812, was presented to England's famous national arms collection as a "tribute to Eli Whitney's contribution to today's industrial achievements and production — America's and Britain's best guarantee of security and progress in the years ahead."

Mr. Polk, who addressed British industrial meetings in his capacity of president of the National Machine Tool Builders Assoc., described the Yankee weapon, first developed by Whitney in 1799 and manufactured through 1812, as the "first product which demonstrated to American and world industry that it was possible to manufacture standardized articles on a mass basis, with interchangeable parts."

Representing a milestone in industrial advancement, this musket was a fitting memento to Eli Whitney's scientific and industrial genius which contributed so much to world progress and better standards of living.

Mr. Polk's musket will be put on permament display in the Tower of London Arms collection started by Henry VIII in the 16th century, according to Sir James Mann, whose office as Master of the Armouries dates from the year 1078.

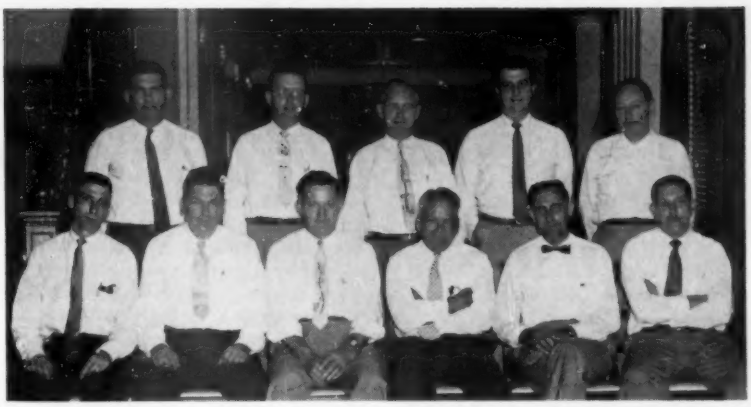
ASTE Member Named To Burma Post

William M. Ramlow, a member of ASTE, has recently received an appointment by the United Nations to the position of tool engineer to assist the Engineering Industrial Project Board of the Government of the Union of Burma.

The work at his new post is significant in that much emphasis is placed on the responsibility of the tool engineer as well as on that of a mechanical engineer.

Mr. Ramlow, who holds bachelor of science degrees in mechanical engineering and commerce of manufacturing, has had many years' experience in engineering.

Mr. Ramlow is plant engineer for Macon Arms, Inc., a subsidiary of Houdaille Industries, Inc., in Decatur, Ill.



Shown at the Area #15 National Program Committee held in St. Louis, Mo., are, left to right: Robert Woods, Springfield, Ill. chapter; Ralph Kuehnel, St. Louis; E. F. Bain, Peoria; John Jones, Little Rock; B. H. Ball, Decatur; John Stern, Decatur. Second row: Marvin Babcock, Evansville; Francis Bowers, National Program Committee member; Clarence Hall, Paul Bartley and E. P. Huchzermeier, all of St. Louis.

SAN FERNANDO VALLEY—Committee chairmen for 1956-57 are, front row, from left: Homer E. Rathbun, professional engineering; Harry Kurz, membership; and Rudolph Powroznik, standards. Second row: Henry T. Young, publications; Clifton Englis, industrial relations; A. J. Soares, editorial; Joseph Bangs, program; Rudolf Regen, historian; Robert Edgcomb, educational co-chairman; and Arthur Lewis, parliamentarian.

Program Planning Session In St. Louis

Tips for program planning highlighted the first meeting of the National Program Committee's Area 15 on July 7 at the Jefferson Hotel in St. Louis, Mo. Similar meetings were held in 12 other areas throughout the country to assist chapters in program planning.

Acting as chairman of the group, Program Committee member Francis Bowers introduced the first topic, ASTE technical program kits, "The Forces in Single-Point Tool Metal Cutting," and "Process Analysis and Control."

The kits are good stand-by programs consisting of specially prepared speaker's manuscript, free illustrated prints of the lecture for audience distribution, and a 35-mm silent slide film.

"Hints for Promoting Speaker Success" was the second item of discussion in which Mr. Bowers emphasized the importance of a proper reception of the speaker, acquainting him with the way the program is handled in the particular chapter, the length of the technical session and question and answer period.

It was decided that a speaker should be acquainted with information about manufacturing plants in the town, thus affording a frame of reference for his talk to make it more interesting and meaningful to the audience.

The importance of utilizing the speaker evaluation form was stressed, as this is essential in making future meetings as interesting and valuable to most members as possible. It was suggested that the evaluation form be given to five members at each meeting so the chapter program chairman might use the composite results of these forms to more accurately fill out the monthly program report form he submits to National Headquarters.

Honor Ladies at Fourth Anniversary Celebration

Woodruff's fashion show and many variety acts were featured at San Fernando Valley's ladies night and fourth anniversary meeting August 8 at Hody's Restaurant, with 105 members and ladies present.

Entertainment was furnished by "The Chaudets," magicians and other performers.

The ladies received Hawaiian wood rose corsages. Mr. and Mrs. Niel Christensen of the Los Angeles "Olive Leaf Press" were present.

—A. J. Soares

Houston Sees Largest Carburizing Installment

Houston chapter members, 200 strong, toured the Hughes Tool Co.'s manufacturing areas including the heat-treatment department, where the world's largest carburizing installment is located. Members were shown rock drilling bits and tool joints in the process of manufacture.

The annual golf tournament was held in cooperation with ASM in May, and in June Mr. and Mrs. W. H. Lloyd acted as host and hostess at the annual picnic at Clear Lake.

—W. H. Reifschneider

Coming Meetings

National

SEMIANNUAL MEETING—of National ASTE Board of Directors, Oct. 25-26, The Greenbrier, White Sulphur Springs, W. Va.

NATIONAL MEMBERSHIP COMMITTEE—Oct. 6. Kansas City, Mo. (partial). Oct. 13, Pittsburgh, Pa. (partial).

Conference

NORTH CAROLINA STATE COLLEGE—Oct. 5-6. Raleigh. Theme: "Tooling and Manufacturing Engineering."

Regional

CANADIAN AREA MEETING—Oct. 20, Hamilton, Ont.

Chapter

ALBUQUERQUE—Oct. 9. The Hilton Hotel. "Tool Steels. Their Usage and Heat Treatments." by R. P. Stemmler, chief metallurgist, Vanadium Alloy Steel Co.

BALTIMORE—Oct. 3. 7:30 p.m., Bartgis Bros. Co., Ilchester. Annual plant tour to see manufacture of folding boxboard and its conversion into folded cartons.

BENTON HARBOR-ST. JOSEPH—Oct. 13, 7 p.m., Tosi's. Annual ladies night with dinner, coffee speaker and entertainment.

BUFFALO-NIAGARA—Oct. 11. 6:30 p.m. Representative of Ex-Cell-O Corp. will discuss "Method X."

CEDAR RAPIDS—Oct. 11, 6:30 p.m., Montrose Hotel. E. V. Crane, chief development engineer, E. W. Bliss Co., will speak on "Deep Drawing Operations and Presses."

COLUMBUS—Oct. 10, 6:00 p.m., Everglades Restaurant. Charles R. Heimliech, Cincinnati Milling, will speak on "Hydro-Spinning and Its Applications."

DETROIT—Carbide section. Oct. 11, "Carbide Tipped Milling Cutters Can Pay Dividends" by L. H. Goddard and Fred W. Lucht of Goddard & Goddard Co. Regular section. Oct. 18. plant tour. Education section. Oct. 25. 8 p.m., Rackham Memorial Bldg. "Materials Handling in the Automotive Industry" by Donald Alcorn, sales engineer, J. B. Webb Co.

ELMIRA—Oct. 1, 6:30 p.m., Joe's Restaurant, Ithaca. "Automatic Presses and Combination of Dies for Quality Stampings" by E. V. Crane, chief development engineer, E. W. Bliss Co.

GOLDEN GATE—Oct. 17. Spenger's Fish Grotto. "Ultrasonic Machining" by J. L. Lovett of Raytheon Mfg. Co.

GRAND RIVER VALLEY—Oct. 7. 8 p.m., Shep's Hall, Galt. "Economics of Tooling as Determined by Quantity, Quality and Manufacturing Methods" by Harry Conn, chief engineer, Scully-Jones & Co.

GREATER NEW YORK—Oct. 24, 7:00 p.m. New York Times Bldg. Paul J. Topelian, research director, Tiarco Corp., will speak on "Hard Chrome Coatings." Representatives of The Tool and Die Makers Association of England to be invited.

HAMILTON DISTRICT—Oct. 12. 6:30 p.m., Fischer's Hotel, Hamilton. "Air Gaging Equipment for Quality Control" by Frank Meyer, air gage engineer, Taft-Peirce Mfg. Co.

INDIANAPOLIS—Oct. 4. 8 p.m., Antlers Hotel. "Automation" by E. W. Denison, manager of manufacturing engineering, Evendale, Ohio, plant, General Electric Co.

KNOXVILLE-OAK RIDGE—Oct. 2. 7 p.m., The Dwarf Restaurant, Knoxville. "Oxide Cutting Tools" by B. F. Bonaker, Carborundum Co., Stupakoff Div. He will be accompanied by S. H. Stupakoff.

LANSING—Oct. 12. Evening. Trip to Great Lakes Steel Corp., Detroit.

LEHIGH VALLEY—Oct. 19. 6:30 p.m. dinner; 8 p.m. technical meeting. "Bell Solar Battery" by Eugene D. Lavery, supervisor, customer information, Bell Telephone Co.

LONG BEACH—Oct. 13, 8:00 p.m., The Clock Supper Club. Annual dance.

LONG ISLAND—Oct. 8. 8:30 p.m., Garden City Hotel. Ladies night and talk by John Mason, director, Dale Carnegie Courses.

LOS ALAMOS—Oct. 10, 8:00 p.m. The Little Theater of the high school. R. P. Stemmler, Vanadium Alloy Steel Co., will speak on "Metallurgical Aspects of Sub-zero Treatment for the Tool Engineer."

LOS ANGELES—Oct. 11. 7 p.m., Scully's Restaurant. "Ultrasonic Machining" by J. L. Lovett, district manager, Raytheon Mfg. Co. Oct. 13. tour of rocket and missile base, Naval Ordnance Test Station, China Lake, Calif.

LOUIS JOLIET—Oct. 16. "The Atom's Use in Tool Engineering" by Dr. Warren McGonnagle, Argonne National Laboratory.

MADISON—Oct. 18, 7 p.m., Leske's. "Four Steps to Better Tools and Dies" by Carpenter Steel Co. representative. Also film, "People, Places and Progress–1975."

MID-HUDSON—Oct. 9, 7 p.m., The Barn, Kingston. "The Meaning of the Machine Tool" by H. E. Linsley, associate editor, *The American Machinist*. Also "Kingston Night" and Ford Motor Co. film, "Techniques for Tomorrow."

MONADNOCK—Oct. 18, 7:15 p.m., Kingsbury Machine Tool Corp. cafeteria, Keene. "Nuclear Energy for the Layman" by J. M. Detwyler, nuclear engineer, General Electric Co.

MUNCIE—Oct. 2, 6:30 p.m., social hour; 7:30 p.m., dinner. "Automation; Is It Good for You and Your Company?" by Ed Flook, regional manager, National Automatic Tool Co., followed by discussion and films.

OKLAHOMA CITY—Oct. 2, 7 p.m., Oklahoma City University Cafeteria. "Engineering Education" by William Henry Carson, dean of engineering at Oklahoma University.

MUSKEGON—Oct. 9, 7:00 p.m., Bill Stern's Steak House. Carboloy Div. speaker on Carboloy cutting tools, ceramic cutting tools.

NASHVILLE—Oct. 9, 6:30 p.m., B. & W. Cafeteria. "Superior Die Sets" by Jean Buhler, sales representative, Southern Tool and Equipment Co.

NEW HAVEN—Oct. 11. Representative of Crucible Steel Co. will speak.

NIAGARA DISTRICT—Oct. 4, 7 p.m., Atlas Steel Ltd., Welland. Plant tour to see latest continuous casting machines for steel; hot planetary stripping mills, electric melting furnaces.

NORTHERN NEW JERSEY—Oct. 9, 8 p.m., The Essex House, Newark. "Carbide Tooling for Small and Large Manufacturing" by S. A. Brandenburg, vice president in charge of sales, Monarch Machine Tool Co. Joint meeting with Carbide Society.

OTTAWA VALLEY—Oct. 16, 8 p.m., Lecture Hall, National Museum, Ottawa. "Oils in Industry" by speaker from E. F. Houghton and Co. of Canada, Ltd.

PHILADELPHIA—Oct. 18, 7:30 p.m., Engineers Club. Edmund Hollingsworth, National Program Committee chairman, moderator, "High Velocity Machining" panel.

PITTSBURGH—Oct. 5, 8 p.m., Gateway Plaza. "Grinding Wheels" by Dr. Harold R. Letner, Senior Fellowship. Second annual educational series on tool steels at Carnegie Institute, Schenley Park, 7:30 p.m. Oct. 1, 8, 15, 22 and 29.

PORTLAND, ORE.—Oct. 18, 6:30 p.m., dinner; 8 p.m., meeting, Burns Restaurant. "Ultrasonic Machining" by J. L. Lovett, district manager, Raytheon Mfg. Co.

ROCKFORD—Oct. 11, 7 p.m., Lafayette Hotel. "Automation in Russia" by Nevin L. Bean, technical assistant to general manager, Automatic Transmission Div., Ford Motor Co.

SAGINAW VALLEY—Oct. 18. Saginaw Steering Gear plant trip.

SAN DIEGO—Oct. 9, 7 p.m., El Morocco Club. "Application and Design of End Mills" by Paul Robinson, sales manager, Brown & Sharpe Mfg. Co.

SAN FERNANDO VALLEY—Oct. 3, 7 p.m., Hody's Restaurant, North Hollywood. "Ultrasonic Machining" by J. L. Lovett, district manager, Raytheon Mfg. Co.

SANTA CLARA VALLEY—Oct. 16, 6:30 p.m. "Ultrasonic Machining" by J. L. Lovett, district manager, Raytheon Mfg. Co.

SCHUYLKILL VALLEY—Oct. 9, 8:00 p.m., Wyomissing Club. "Automation" by John Keats, National Automatic.

SOUTHEASTERN MASSACHUSETTS—Oct. 16, Elks Hall, Brockton. "Metal Forming" by Philip Mackinson, The Marblette Corp.

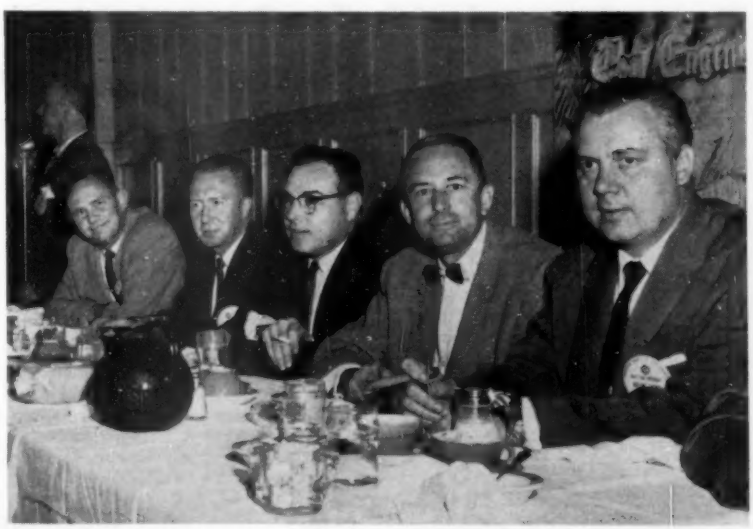
SYRACUSE—Oct. 10, 8 p.m., Hotel Onondaga, Hiawatha Room. "Modern Methods of Gear Mfg.," by representative of National Broach & Machine Co.

ASTE 25th Annual Meeting and Silver Anniversary celebration will be held March 25 through 27, 1957, at the Shamrock Hilton Hotel, Houston, Texas.

TOLEDO—Oct. 10, 8:00 p.m., Maumee River Yacht Club. "Outermost Part of the World," Lou Klewer, of Toledo Blade. Past Chairmen's Night honoring Ray Peterson, retiring national director.

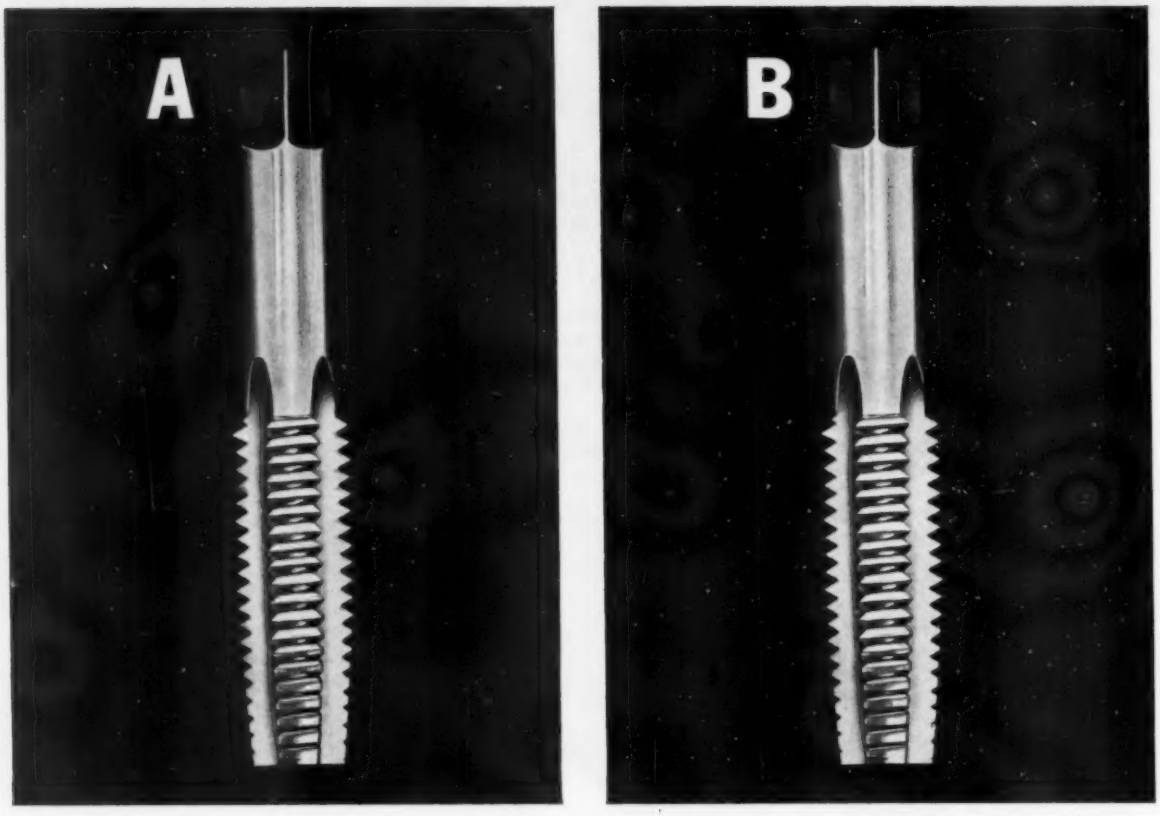
TRI-CITIES—Oct. 10, 2 p.m., International Harvester Co., East Moline, Ill. Plant tour.

WORCESTER—Oct. 2, 7:30 p.m., Putnam & Thurston's. "Ceramic Cutting Tools," by H. J. Siekmann, General Electric. Joint meeting with Society of Carbide Engineers, Worcester chapter.



LOS ANGELES—Shown from left to right at Los Angeles' August meeting are: Chairman Frank X. Bale at the mike; Ben Hazewinkel, second vice chairman and past national director; Al Beaumont, secretary; George Tilden, treasurer; Paul Lenk, first vice chairman; and Wayne Ewing, national vice president.

WHICH OF THESE TAPS COULD NEVER GET PAST HY-PRO'S ELECTRONIC ANALYZER?



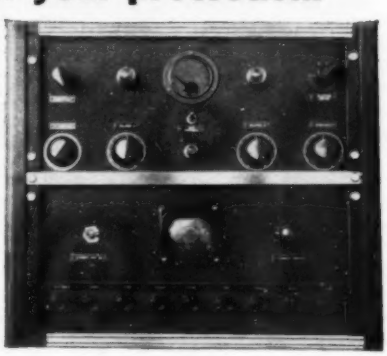
The serious defect in Tap B is invisible. But Hy-Pro's Electronic Analyzer detects all structural flaws for your protection.

HY-PRO'S amazing new Electronic Analyzer is one of the three important steps which Hy-Pro takes to insure you of *3-way Quality Control*. These three steps are the Electronic Analyzer, advanced Heat Treating and the Micro-Hardness Tester.

Here's how the Electronic Analyzer works. A standard tap, perfect in every detail, is put in one side of the machine. The tap to be tested is put in the other side. Electronic impulses are shot through both taps and every inch of each tap is tested as to composition, surface condition and internal structure.

The Hy-Pro Electronic Analyzer reveals every defect, including those that laboratory, production tapping and destructive tests fail to uncover!

The best part of the Hy-Pro story is that you get the benefit of these new Hy-Pro developments at no extra cost to you. Get in touch with your nearest Hy-Pro distributor or call us direct. Hy-Pro *quality-controlled* taps—products of the Tap Specialists—cost no more than ordinary taps.



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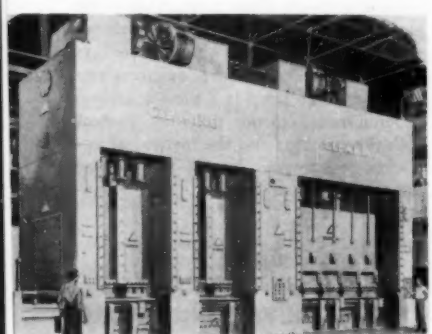
PROGRESS IN PRODUCTION

PRESS DESIGN DELAYS OBSOLESCENCE

Introduction of a different press design suggests that manufacturers may have the means to alter physical characteristics of presses to meet future manufacturing needs. Clearing Machine Corp., division of U. S. Industries, Inc. has developed presses of modular con-



struction which can be modified to provide for major model changes.

An example of the Transflex equipment is a giant press that produces washer and dryer tops for General Electric. The installation is 58 ft. long with twin drives and two crowns and two beds sharing common uprights. It has a transfer feed stroke of 50 in. and will produce over 700 stampings per hour. Designed for integrated production, the press produces washer tops for four hours and then, after only a 10 minute change-over period, converts to four hours of dryer top production.

Split side construction on the first two stations makes the quick change-over time possible. Non-used punches can be adjusted up and out of the way. Several retractable subslides, mounted on the bottom of the large slide, can be adjusted rapidly during change-over. On all slides and subslides there is micrometer shut height indication.

As model changes alter production needs, the modular unit may be separated into two presses, or it may remain as at present and another modular may be added to either end of the machine to increase the number of available stations. Still another alternative could be the addition of modular units between present sections to alter the sequence of tonnage capacities, etc.

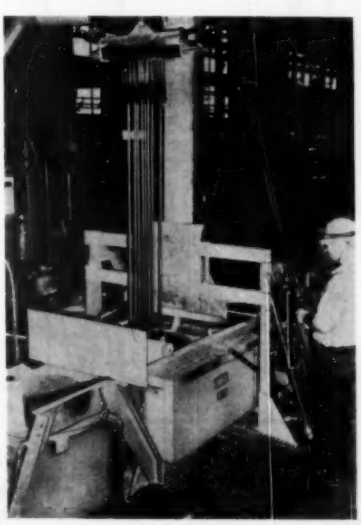
INGOT PRODUCTION BY ELECTRONIC CONTROL

Cleaner, more uniform and precise weight ingots are being produced as a result of installation of electronic equipment at Colonial Metals Co. According to Martin Sanger, president of the company, automation also is expediting production. Electronically controlled conveyors now pour the molten aluminum. A control panel permits adjustment of conveyor speed and automatic pouring. This technique provides uniform predetermined weight ingots to customer specifications. Although automatic pouring avoids excessive agitation of metal, assuring a clean, solid ingot free from dross and other inclusions, skimming is still performed.

HEAT TREAT METHOD YIELDS DISTORTION-FREE RODS

Chromium-copper alloy rods ½ to 2 in. in diameter and up to 12 ft. long are being solution heat-treated without distortion at Mueller Brass Co. Prior to this, bars were heat-treated horizontally in direct gas-fired furnaces and distortion was a prime problem. Solution came with heating the bars vertically in a salt bath furnace made by Ajax Elec-

Chromium-copper bars 12 ft long are charged into the 115 kw Ajax solution heat-treating furnace. Time-temperature cycles for copper base alloy rods range from 20 to 30 minutes at 1825 F.



tric Co. of Philadelphia.

Despite the 15-ft depth of the furnace, temperatures anywhere within the bath are maintained within 10 deg of the temperature control setting. Four pair of submerged electrodes which enter the furnace at four different levels stimulate self-circulating action and make temperature uniformity possible.

Since this technique of solution heat treatment of copper-base alloy rods has been in effect, yield has increased 25 percent, while actual heat-treating time has been cut about 75 percent. Distortion is no longer appreciable, and scaling is nonexistent. Tests indicate that hardness values are more uniform than before.

GUN SUCCESSFULLY APPLIES PROTECTIVE COATINGS

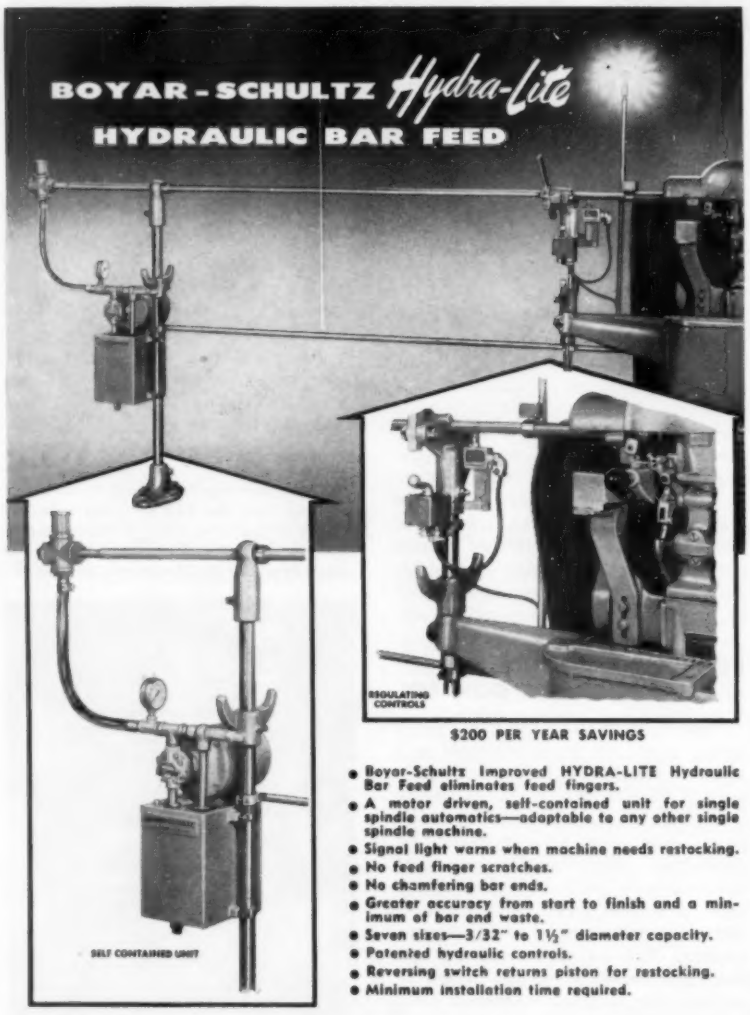
Special oxide coatings have proved particularly successful when applied through a special metallizing gun in protecting underlying metals from abrasion and excessive heat. These Rokide coatings, developed by Norton Co., showed good protective qualities during early experimentations but did not adhere well to the base metals. Subsequently the materials were developed in rod form so they could be applied through an oxyacetylene gun specially designed for the purpose by Metallizing Co. of America. The new gun reduces the rod to molten particles at temperatures in excess of 5000 F and projects the molten particles at high velocity by compressed air onto the metal surface to be coated. Previous roughening by grit blasting prepares the surface for the coating, and the resultant bond shows good adherence. By its nature, the coating is slightly porous in structure, and shows good flexibility.

To spray the coatings successfully the gun has to feed the rod at a speed sufficiently slow and uniform to permit the rod to reach the proper temperature in the oxyacetylene flame for proper atomization before being sprayed on the parent metal. A special electric drive provides an accurate, steady speed while feeding the rod as low as 3 ipm.

At present three Rokide coatings are available in rod form for coating metal in $\frac{1}{8}$ and $\frac{5}{16}$ in. diam. sizes. One is the aluminum oxide; a second is a zircon rod which dissociates into zirconium oxide and silica in the oxyacetylene flame; and the third is a time-stabilized zirconia rod. Norton patents protect both the coatings and the method of application; however, Norton will license companies to use the coating on a nonexclusive basis.

SELECTIVE BYPASS CONTROL FOR METAL FINISHING WORK

Automatic control of as many as nine complete metalfinishing processes on a single anodizing or electroplating machine is possible through a recently developed bypass mechanism. The device, is part of a "Dial-A-Cycle" system made by Hanson-Van Winkle-Munning Co. This system is controlled from a dial on the carrier arm that moves parts through processing tanks. As unfinished parts are loaded on the carrier, the dial is set for the processing steps through which the load is to move. Automatically conveyed parts are then lowered into prescribed tanks, and carried past



$200 PER YEAR SAVINGS

- Boyar-Schultz Improved HYDRA-LITE Hydraulic Bar Feed eliminates feed fingers.
- A motor driven, self-contained unit for single spindle automatics—adaptable to any other single spindle machine.
- Signal light warns when machine needs restocking.
- No feed finger scratches.
- No chamfering bar ends.
- Greater accuracy from start to finish and a minimum of bar end waste.
- Seven sizes—3/32" to 1½" diameter capacity.
- Patented hydraulic controls.
- Reversing switch returns piston for restocking.
- Minimum installation time required.

BOYAR-SCHULTZ CORPORATION Dept. D-S, 2004 SOUTH 25TH AVENUE

BROADVIEW, ILLINOIS

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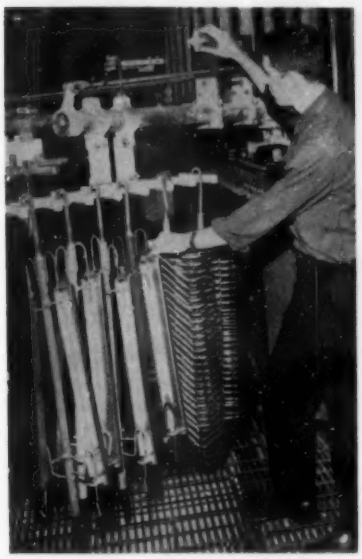
others according to the preset order.

Heart of the system is a series of limit switches and solenoid-operated setdown flippers that control the action of the carrier. Different dial settings change the position of a flag which subsequently contacts or passes switches and



Parts are loaded onto anodizing machine that utilizes new bypass mechanism and operator sets dial at start of cycle.

flippers at each tank in the metalfinishing sequence.

An almost infinite combination of sequences and swell periods for cleaning, rinsing, etching, anodizing, plating, coloring and sealing can be achieved. After the operator rotates the dial to its proper setting, no further manual operation is necessary until finished parts are unloaded.

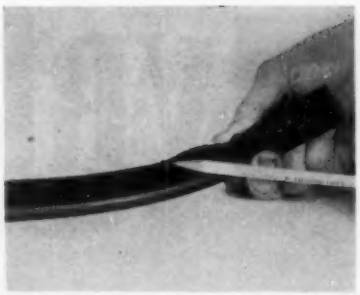
BUTTONED SEALING STRIP SPEEDS ENGINE ASSEMBLY

Sealing strips are being attached to aircraft engine deflectors by a new method at low cost, high engine safety, and low field repair time as compared to conventional means. Metal strips and rivets have been used to attached rubber sealing used on the R-1820 and R-1300 air cooled engines at Lycoming Div. of Avco Mfg. Corp. Results was a chaffing problem between metal strips and mating deflectors.

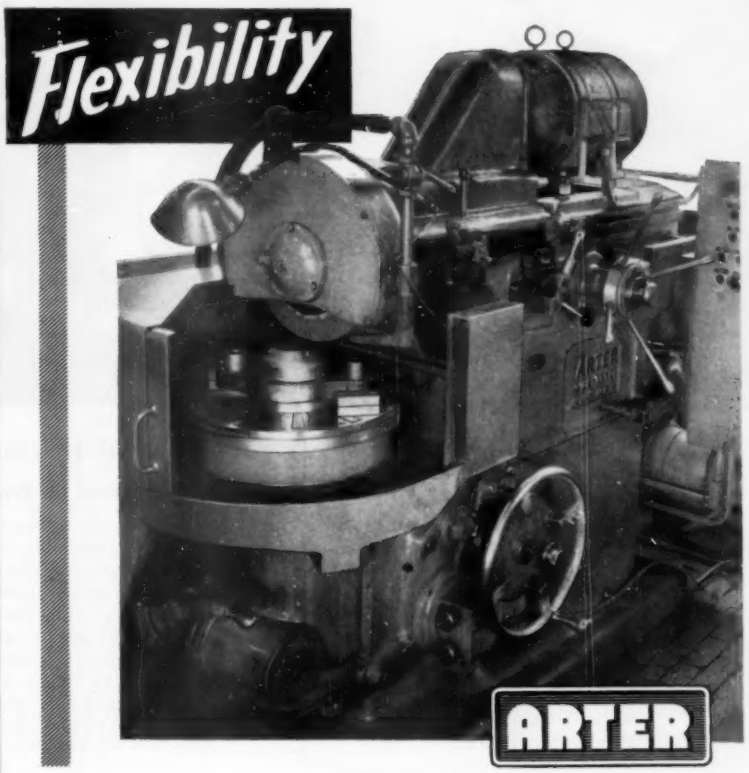
The new process, developed by a Lycoming engineer, incorporates rubber buttons on the seal flange, Thus the seal can be attached directly to the deflector by inserting the buttons through drilled holes in a single stage operation, and metal strips and rivets are eliminated.

Avco division engineers list several

Right. Pencil points to "buttons" which make it possible to attach the seal directly to the deflector.



resultant savings because of the method. Primarily there is saving of material and tooling; there is no need for rework of strips and riveting; time, labor and cost involved in assembling strips and rivets have been reduced. In addition, seal is used for locations that previously have been considered inaccessible for lack of space.



Arter Model D Rotary Surface Grinders are extremely flexible in their application to a wide range of surface grinding problems. By using special chucks, many seemingly difficult surface grinding jobs are made easy, permitting great savings in set-up time.

Here is one of General Electric's Arter Model D 16" Rotary Surface Grinders being used to grind punches for motor laminations. The chuck has a large diameter central hole to provide clearance for the shank.

The Arter Model D has great vertical capacity, hand and automatic feeds and a tiltable worktable. An arrangement for grinding work in a complete automatic push button cycle can be supplied.

For the best answer to your surface grinding problems — ask your Arter engineer.

ARTER GRINDING MACHINE COMPANY

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Jigmatic Automatic Tape Controlled Positioning Table • Rotary Surface Grinders
Flat Circular Cutter Grinders • Internal Grinders • Cylindrical Grinders • Carbide Tool Grinders

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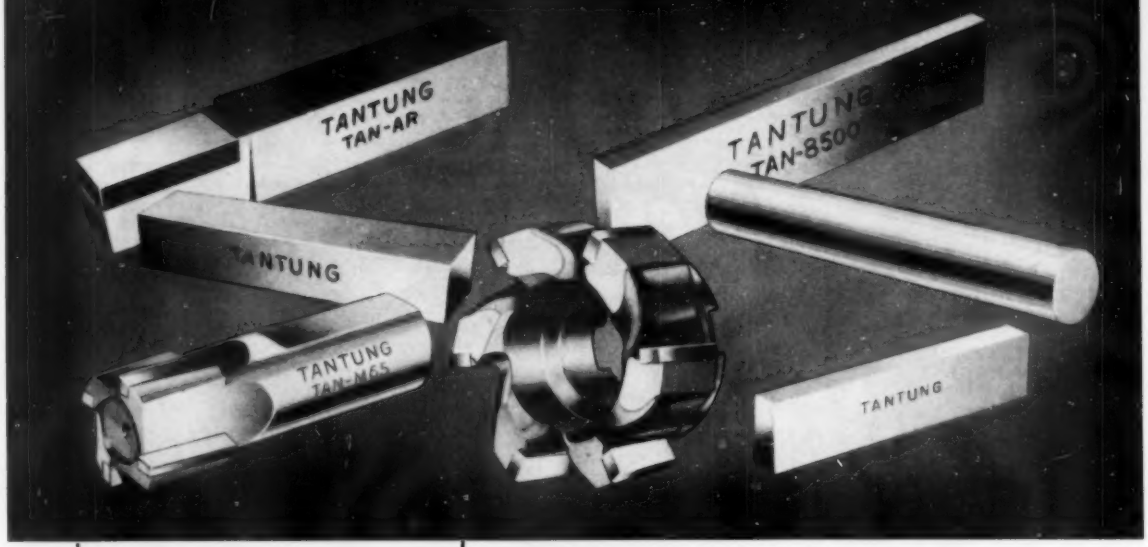
V-R TANTUNG CAST ALLOY

cuts twice as fast as High Speed Steel



Facts You Should Know About TANTUNG, V-R's *Exclusive* Cast Alloy:

- **TANTUNG CONTAINS CARBIDES**—of tungsten, tantalum and columbium. This combination gives it superior toughness and lower friction coefficient than ordinary cast alloys.
- **TANTUNG IS STRONGER**—transverse rupture strength double of most cast alloys.
- **TANTUNG HAS HIGH RED-HARDNESS**—it maintains cutting hardness at red heat temperatures well above that of high speed steel.
- **TANTUNG IS EASY TO GRIND**—aluminum oxide wheels used for hardened steel are suitable.
- **TANTUNG IS AVAILABLE PREFORMED**—when you buy preformed tools, you save grinding costs and get better cutting quality and longer tool life.

When Tooling AUTOMATICS— Don't Overlook TANTUNG!

V-R and TANTUNG are registered trademarks of Vascoloy-Ramet Corporation.

High Red-Hardness — Plus Low Friction

lets you speed up your machines and cut your costs . . .

As a general rule, when using TANTUNG cast alloy cutting tools, you start your machines at about twice the speed you would use with high speed steel tools. TANTUNG bridges the gap between the maximum speeds possible with high speed steel and the minimum speeds practical with cemented carbides. Its general cutting range lies between 80 and 180 surface feet per minute, subject to some variation according to machining operation and material being cut.

And, TANTUNG is at its best under heavy feeds!

Here is a typical example:

JOB: Recessing high alloy steel ring gear forging on Potter and Johnson Semi-Automatic.

	H.S.S.	TANTUNG
Speed:	94 R.P.M.	165 R.P.M.
Feed:	.004"	.008"
Depth of cut:	.125"	.125"
Pieces per grind:	35	70
Av. pieces per shift:	38	100

. . . more than 2½ times production increase!

If you want to reduce costs and increase productivity, take a good look at TANTUNG.

GET ALL THE FACTS in this 24-page free catalog containing charts, tables, recommendations and data. Send for yours today.

MANUFACTURERS OF:
CEMENTED CARBIDES AND TANTUNG CAST ALLOYS • TOOLS • BLANKS • DIES
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TOOLS *of today*

Automatic Lathe

The Reedmatic automatic production lathe, available in several sizes and combinations of mechanical feeding or hydraulic tracer slides, can be tooled in a wide variety of arrangements for short-run or high-production turning.

Two models are available. The C-30 machine has an 18-in. swing over the carriage ways and 12 in. over the cross slide ways. Its maximum input is 30 hp. The C-60 model swing over the carriage ways is 24 in. and 16 in. over the cross slide ways. Maximum input is 60 hp. Both models can be arranged for chucking or between center work if desired.

Longitudinal turning slide of this lathe is mounted so the entire front of the machine is open for unobstructed chip drop. Wide range of spindle speed changes is available.

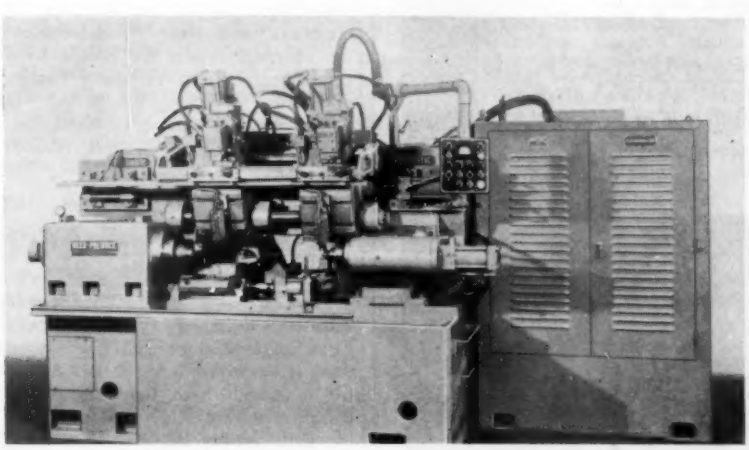
Spindle action is such that there is no lifting action on the turning or facing slides, and no need for upside-down tools.

Hydraulically operated clutch and brake require no adjustment. Automatic lubrication starts simultaneously with spindle motion.

The lathes are arranged for either mechanical or hydraulic feeds to the turning and facing slides. If used, the tracer is mounted 90 deg from center line of spindle, permitting mounting of multiple tracing slides to operate independently or simultaneously. The tracer-controlled slide can feed transversely as well as longitudinally.

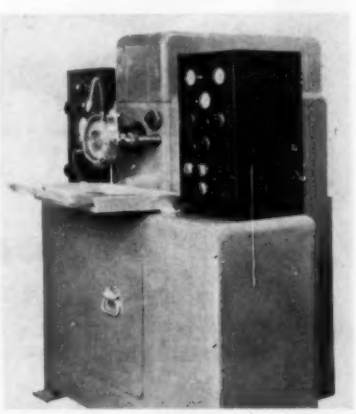
Diameter and lateral size control is provided without disturbing the position of the cutting tool and toolholder. Multicycle control will automatically position the tool slides for any predetermined number of cycles.

Reed-Prentice Corp., Worcester, Mass. **T-10-1451**



Honing Machine

Electronically controlled honing machine offers a range of cutting speeds for honing precision parts. Limit switches control both the honing of the part and complete usage of the honing stone. The same stone can be used either to hog out stock or obtain a fine finish. Dimensional accuracy of a tool-room nature can be secured on a production run.



The honing machine provides feed and speed control from 100 to 1600 rpm using limit switches and adjustable-speed motors. Automatic loading of workpieces is custom engineered.

Automatic sizing, embodying a pneumatic measuring device, not only ends the honing cycle when desired size is reached, but also permits the operator to visually check the bore during honing.

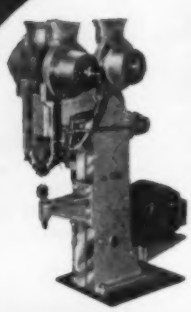
Stone pressure control is also auto-

AT Chicago Rivet ALL 3
will reduce your Fastening Costs

rivets

Semi-Tubular, Split and Shoulder

You avoid machine down-time because every semi-tubular, full tubular, split, shoulder or special rivet is precision made and hand inspected to assure free, non-clogging movement in automatic setters.



rivet setters

Your fastening costs are less because Chicago Rivet makes machines that set from one to seven rivets at a time. Riveting is automatic and may involve the use of special indexing fixtures, adjustable riveting centers, and top or bottom rivet feeding and other mechanisms, controlled by solenoids or air cylinders or both.

engineering

The recommendations of Chicago Rivet Engineers are most valuable. Their knowledge of rivet fastening techniques, gained from solving thousands of manufacturers' fastening problems can help make your product more competitive. Calling Chicago Rivet is a habit-formed procedure with many companies. You incur no obligation when you use the service of Chicago Rivet Engineers. Send a blue print or sample assembly with your inquiry.

Chicago Rivet & MACHINE CO.

9619 WEST JACKSON BOULEVARD
BELLWOOD (CHICAGO SUBURB) ILLINOIS
BRANCH FACTORY: TYRONE, PA.

New Rivet Catalog contains engineering data, list of popular semi-tubular, full tubular, split and shoulder rivets and popular automatic rivet setters. Write for copy.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-146

matic. Cutting pressure, determined by stone characteristics and part specifications, is infinitely adjustable. Dangerous overloading is prevented by the pneumatic circuit.

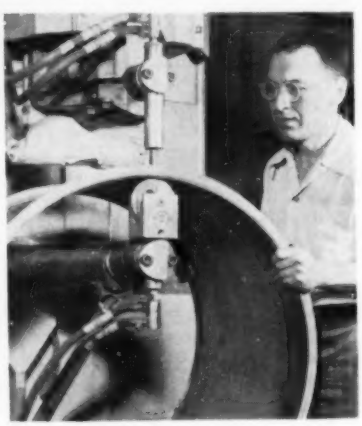
Stone "feed-up" is automatic and integral with the stone pressure control, eliminating need for adjustments to compensate for wear. Automatic stone "use-up" control permits maximum use of honing stones. Neither part nor mandrel can be damaged because the machine cycle is stopped when the abrasive is completely worn down.

National Pioneer, Inc., Box 668, Muncie, Ind. **T-10-1461**

USE READER SERVICE CARD ON PAGE 167 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Electrode Wheel Holder

This lower electrode wheel holder can be used for flat or circular workpieces. The electrode, in the form of a wheel is mounted in a solidly constructed holder and is machined from copper



alloy. Silver-plated bearings of the wheel shaft assure good thermal and electrical conductivity. Workpiece and the electrode wheel are cooled by a supplemental jet type water cooling apparatus.

The Weldma Co., 62 Lasalle Rd., West Hartford, Conn. **T-10-1462**

Single-Point Threading Tool

This threading tool, called Spee-D-Thread, is designed to permit fast, efficient single-point threading on a reversible engine or turret lathe. A ductile-iron main base tends to absorb vibration and lessen possibility of chatter while cutting threads. It is so at-

tached to the compound that it remains rigidly in position.

An upper anvil has a tapered hole which fits onto a tapered cone on a lower anvil, which in turn is pressed into the main base. During the cutting stroke, the anvils are held in place by cutting forces.

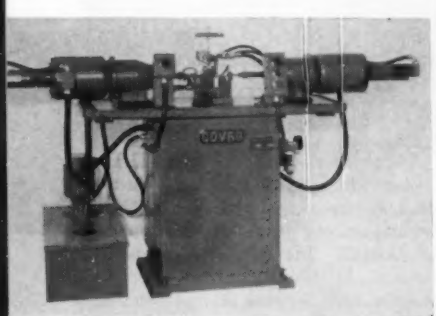
After the tool is set for the depth of the first cut, either the cross slide or the compound may be used to feed in the tool for succeeding cuts. Limit switches can be set to limit the forward and reverse travel of the carriage, making the operation automatic. Speeds may be increased to the limit of the cutting tool.

Easco Products, P. O. Box 587, Ypsilanti, Mich. **T-10-1471**

Automatic Centering Machine

Centering operations on such parts as motor camshafts and crankshafts are performed automatically at a high production rate on this unit.

The machine, which incorporates two opposed automatic drilling units, is simple to operate. The operator merely loads the part into a fixture and depresses the start cycle switch. Work is automatically clamped, centered at both ends and unclamped, ready for the operator to remove. Production rate is approximately 360 pieces per hour.



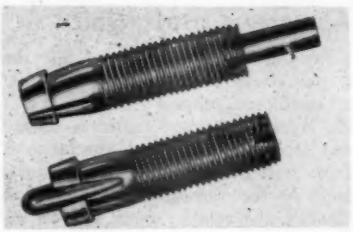
By making minor changes, the machine can be readily adapted to a variety of parts.

Govro-Nelson Co., 1933 Antoinette, Detroit 8, Mich. **T-10-1472**

High-Strength Fasteners

Parts can be bolted easily in blind areas, where standard bolts cannot be inserted, with this Drivebolt high-strength fastener. It is inserted from the nut side of the job with no special tools.

Installation is simple and quick. The fasteners form their own blind heads automatically behind the hidden side of the work, to which they are attached. The unit, which is 2 in. long, consists of bolt and pin, made of cadmium-plated steel.



Southco Div., South Chester Corp., 200 Industrial Hwy., Lester, Pa. **T-10-1473**

Spray System for Plastic

The KiPlaGun was developed to spray a 100 percent reactive epoxy system (nonsolvent) which may be used for corrosion resistant coating, laminating or adhesive materials.

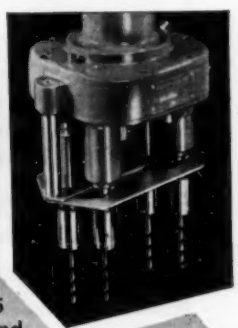
This unit consists of two pressure pots (one for resin, the other for hardener), a metering unit and the heated gun. Material output is up to 2 lb per minute and a wire range of ratios of resin to hardener.

The gun is electrically heated to reduce viscosities of the materials used and encourage their mixing in the non-clogging internal mixing chamber. Triggering arrangement of the gun has three positions: air; air and resin; air, resin and hardener. When the gun is

Specify...

WISCONSIN DRILL HEADS

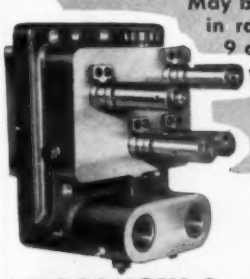
for High-Production Drilling, Boring or Reaming



Wisconsin Adjustable Spindle Drill Heads, completely gear driven, are available in 5 Standard Models, with 2 to 8 Spindles and drill capacities from ¼" to 1½". They are equipped with both Locating and Locking templates, an *exclusive patented feature.* May be adjusted to any hole pattern within range of head. Adjustable Heads with 9 or more spindles are built to order.

Adjustable, Multiple Spindle Drill Head

Fixed Center Drill Head



Wisconsin Fixed-Spindle Drill Heads are built to special order in any size or capacity for Drilling, Boring, Reaming, Spot-facing or Milling operations.

WISCONSIN Tapping Heads *and* Lead Screw Tapping Units

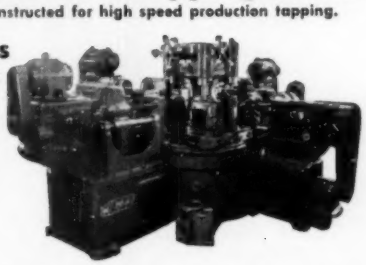
are precision constructed for high speed production tapping.

WISCONSIN Special Machines

Index Type and Fixture Bases

● SPECIAL 4-WAY MACHINE

Drills and taps several different sizes of V-4 engine blocks. Machine and fixtures are designed to handle various sizes of V-4 engine blocks by the use of interchangeable fixed center drill and tapping heads.



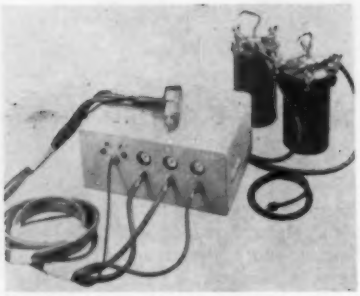
Literature Sent Upon Request. Write —

WISCONSIN DRILL HEAD CO.

4985 NORTH 124th STREET • BUTLER, WISCONSIN

A56-9029-1P

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-147



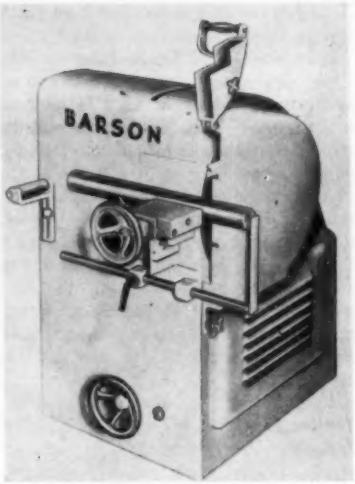
to be set aside for short periods the mixing chamber may be flushed out with air and resin and there is little danger of setting up. It is easily and quickly disassembled.

Kish Industries, Inc., 1301 N. Turner St., Lansing 6, Mich. **T-10-1481**

Abrasive Cutoff Unit

Regular peripheral speed of the cutting wheel on this high-capacity cutoff machine, identified as LTSa, is 20,000 sfpm. The cut obtained is square and almost burr free. A special gear drive permits continuous speed regulation. As the diameter of the wheel is reduced, the spindle speed can be increased so the cutting speed remains optimum.

Wheel supplied on the unit is a universal type, suitable for cutting any material, including high-speed steel, aluminum, bronze, copper, cast iron, brake linings, synthetic fibers, resinoid, porcelain and plastics. Selection of wheel is according to size of material only. It will cut steel rod up to 2½ in. in diam, bar steel 2 in. square, tubes



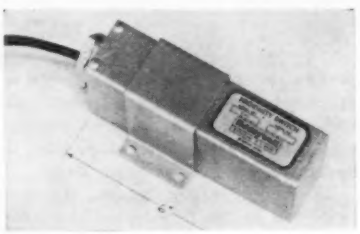
up to 4 in. in diam, and iron sections up to 4 in.

Cutting feed is designed to operate horizontally to avoid cutting wheel damage. When unloaded, the wheel withdraws into the protection hood. The fully enclosed motor has intermittent capacity and will safely carry a 20 percent overload during cutting.

Wandsbeker Werkzeug Gessellschaft Beinhoff & Co., 24a Hamburg-Wandsbek, Konigsreihe 3, Germany. **T-10-1482**

Proximity Switch for Assembly-Line Work

Moving metal part positions are checked continuously by this magnetic switch which locates objects containing iron on assembly lines, in liquids and among moving parts of automatic machine tools. The switch has no moving



parts. Detection is accomplished when a magnetic field, set up directly in front of the switch's sensing end, is altered by a metal object. A signal flows through the magnetic circuitry of the switch and operates a remotely located electrical control relay. This relay can be triggered up to 10 times per second.

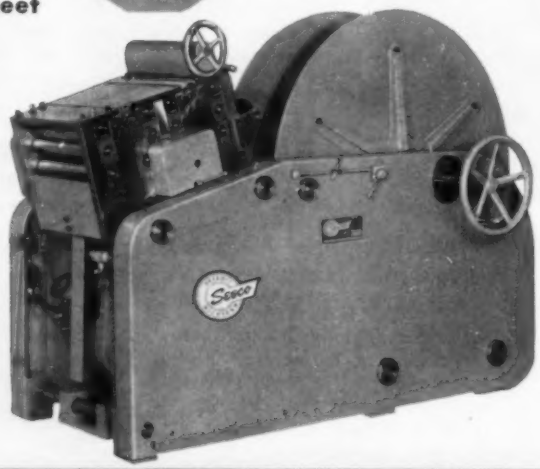
In assembly-line operations, switches may program the operations as the metal part moves from one station to another. Any break in the sequence is immediately detected and the signal can

Sesco

COMBINATION CRADLE AND STRAIGHTENER

Power driven rolls or conveyor, cradles coil stock. Straightener unit provides individual adjustment on upper pinch and straightener rolls. Positive aligning wedge mechanism is employed to adjust rolls. Loop control arm regulates flow of stock. The Unit is sturdy and reliable.

Sesco will furnish equipment to meet your specific requirements.



For Complete Pressroom Automation

Write for Catalog

Sesco INC. 8881 Central Detroit 4, Mich.

engineers & manufacturers of machine tools and press room equipment

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be used to stop the line.

Magnetic design of the proximity switch avoids both internal electrical contacts and linkages, and the need for physical contact with the object to be detected.

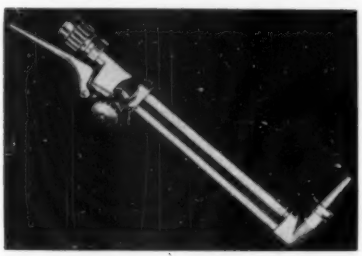
The new switch is 6 in. long and 1⅝ in. square and is sheathed in a heavy steel housing. The magnetic circuitry is embedded in a solid plastic solution. Sensing poles in the switch are designed to detect metal objects within ⅛ in. of its face. In the case of machine tool operation, the new switch cannot be set off by falling metal chips.

Minneapolis-Honeywell Regulator Co., Doelcam Div., 1400 Soldiers Rd., Boston, Mass. **T-10-1491**

Cutting Attachment

Lightweight Prest-O-Weld CW-120 cutting attachment for intermittent cutting on light sheet and plate converts the Prest-O-Weld W-120 welding blowpipe for cutting iron and steel up to 2 in. thick.

This new attachment is designed to provide high efficiency and long life.



Rigid, thick-walled tubes are made from hard-drawn brass, and anchored for hard use.

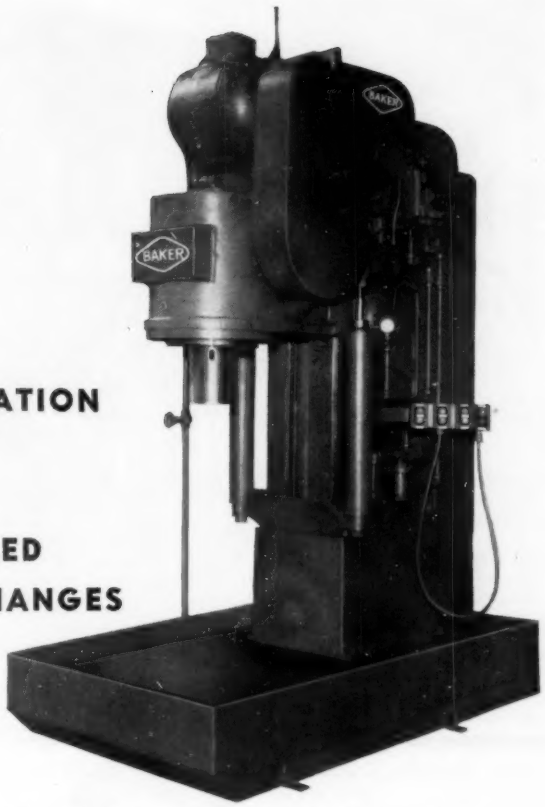
Cutting nozzles are available in three sizes for general-purpose cutting ranging from 1/16-in. sheet to plate 2 in. thick. Over-all length of the attachment is 10 in; connected to the Prest-O-Weld W-120 welding blowpipe, it measures 14 in. Weight of the CW-120 with the largest size cutting nozzle is only 13½ oz.

Linde Air Products Co., 30 E. 42nd St., New York 17, N. Y. **T-10-1492**

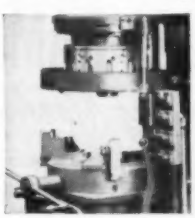
Metering System for Mixing Resins

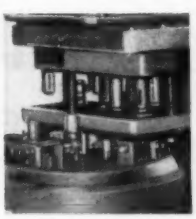
Multicomponent mixing and metering dispensing systems are available for continuous proportioning of resins (including abrasive fillers) and hardeners with component viscosities up to 1,000,000 cps at ambient temperatures, or for special application at elevated temperatures. The designs are readily adjustable for a wide range of ratios and can

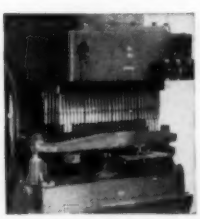
AUTOMATION THAT'S EASILY RETOOLED FOR CHANGES



Baker Basic machines don't have to be "rebuilt" when you change your product or methods . . . cost much less than a machine specially designed for only one part . . . and pay for themselves even on lower production runs. Yet they still give you full automation with loading and unloading devices and conveyors . . . which we'll furnish as well as tooling. Use singly or in battery as a transfer machine . . . for drilling, boring, tapping, facing and other machining operations. 5 sizes.


Boring


Drilling and reaming with index fixture


Multiple drilling

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AUTOMATION
Best in the long run
Practical in the short run

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Toledo 10, Ohio

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COMPANY

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be used with two or more components.

Basic design uses a positive acting hydraulic escapement mechanism with double feed-back control to yield errors less than ± 0.5 percent of any one component. Errors are not cumulative.

Each increment of material is made to required proportions because of simultaneous and continuous metering of all components. This condition allows the usage of "Flow-through" mixer-reactor designs of 5 to 10 cc net volume with mixing capacities to 4 liters per minute.

Metered mix discharge can meet production demands up to 100 shots per minute. Discharge pressures to 3000 psi are available. The mixer-reactors are cleaned and protected against freeze-up with short pot-life mixes by automatic purge. The systems may be used continuously or intermittently.

The entire system is sealed and under pressure so that air and contaminates are excluded. The operator need never contact the materials being handled.

Applied Engineering Associates, 1952 Flushing Ave., Brooklyn 37, N. Y.

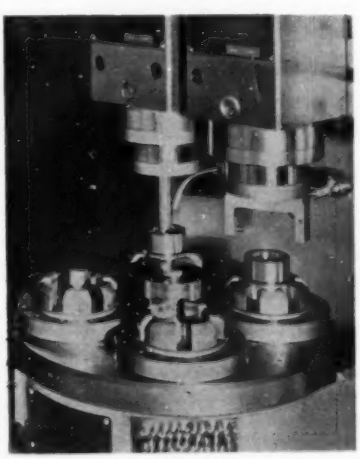
T-10-1501

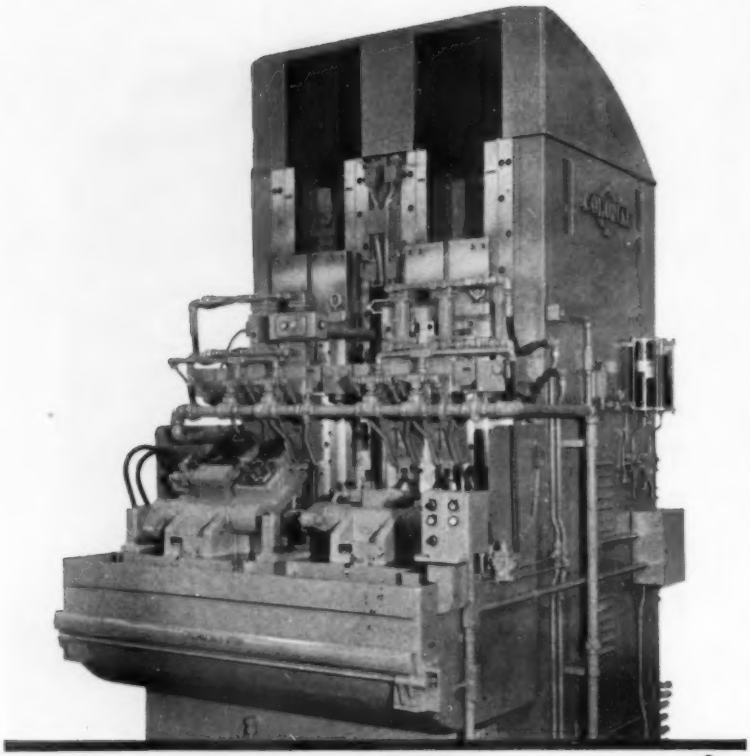
USE READER SERVICE CARD ON PAGE 167 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

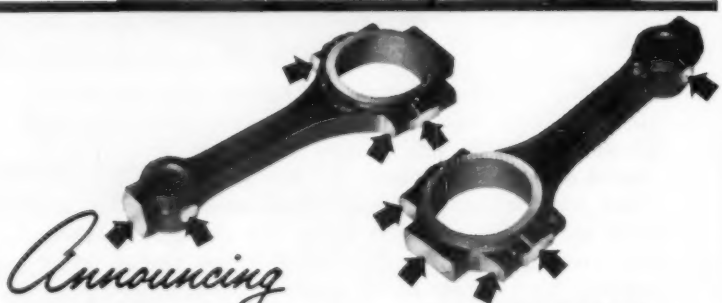
Index Table

Model AIT, automatic indexing table, is accurate within 0.0005 in. of true position. Primarily intended for use on the Wadell vertical precision boring machines, it is also readily adaptable to other machine tools. The table is completely electrical and can be either synchronized with the machine cycle or manually indexed.

Feature of the index drive is a mechanism which requires only three moving parts. Accuracy is dependent on a specially designed precision-machined







Announcing

NEW *ElectroGear* DUAL RAM

Broaching Machine

Automotive connecting rods are being broached at a 450 per hour rate on a new Colonial ElectroGear dual ram broaching machine. Finish on broached surfaces is definitely superior—tool life is longer. Cutting speed is 45 feet per minute.

Side by side broaching on each ram (balancing pad and locating pads) produces two completed parts with each cycle of the machine.

New Colonial ElectroGear drive broaching machines are made in dual ram vertical and single ram horizontal models. Your Colonial representative can tell you about the new high in broaching performance that you can get with these machines. Write for information.

COLONIAL

BROACH & MACHINE CO.

DETROIT 13, MICH.

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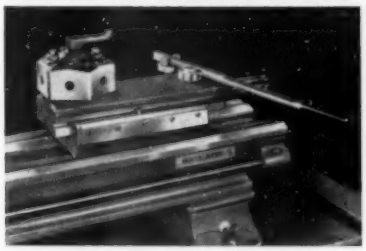
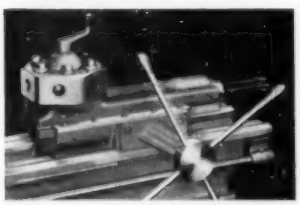
Simplify
Repetitive Operations with
SOUTH BEND TURRETS



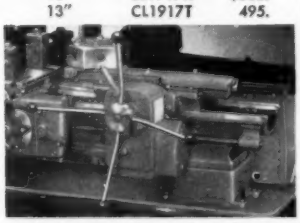
HANDLEVER BED TURRET
Indexes ± .0005" at 4". Superfinished index pin. Automatic indexing and feed stops. Effective slide feed 4".

Size Lathe	Catalog No.	Price
9"	CL1611N	$273.
Light Ten	CL1611K	280.
10"	CL1611R	286.
13"	CL1611T	308.



HAND FEED TURNSTILE BED TURRET
Indexes ± .0005" at 4". Automatic indexing and feed stops.

Size Lathe	Catalog No.	Price
16"	CL1917H	$683.
13"	CL1917T	495.



POWER FEED TURRET FOR 13" LATHE
Independent feed trip and stop for each of six turret faces. $698.

SQUARE TURRET TOOL BLOCK
for Compound Cross Slide
Mounts 4 cutting tools. Turret indexes within .0005" to 4 positions. Quick acting lever lock. For 9" to 16" Lathes — $46 to $91.

Write for Attachment Bulletin.

SOUTH BEND LATHE
South Bend 22, Indiana
Building Better Tools Since 1906

INDICATE A-10-151-1

master index plate. Total tolerance of index positions is within 0.0003 in. The lockpin is heavy rectangular cross section and moves on preloaded rollers that prevent play. The table rotates on preloaded precision heavy-duty tapered roller bearings that allow for thrust loads in all directions. The spindle is hollow so air or hydraulically actuated chucks, or other holding means can be used.

Standard master plates have 12 index positions; masks are used to obtain spacings of 2, 3, 4 and 6. Irregular spacings can be furnished. Diameters of 12, 18 and 24 in. are standard.

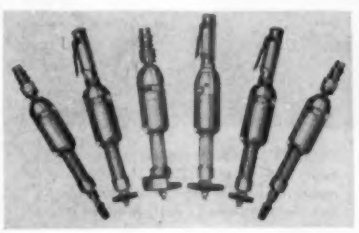
Wadell Equipment Co., 119 South Ave., Garwood, N. J. **T-10-1511**

Heavy-Duty Die Grinders

Three heavy-duty die grinders, in lever throttle or Q.A.W. versions, are designed so that 75 percent of their parts are interchangeable in models that range from 3-in. grinders at 12,000 rpm to ¼-in. collet type tools at 20,000 rpm.

As compared to previous tools, the new units have increased power, larger blade area and longer rotors.

By channeling exhaust air through more than 100 milled, gearlike slots



around the circumference of the motor housing, noise level is kept very low.

First tools produced in the new models are the 650's at 12,000 rpm; the 640's at 17,000 rpm; and the 602's at 20,000 rpm. Weights range from 5 to 5 lb, 4 oz., and length from 12¾ to 14¼ in.

Master Pneumatic Tool Co., Inc., Bedford, Ohio. **T-10-1512**

Heavy-Duty Punch Press

Model B-5 heavy-duty 5-ton punch press will perform up to 280 operations per minute in punching, shearing, forming, riveting, blanking, cutting, drawing, etc. leather, fiber, plastics, textile, paper, metal or other workable material within rated capacity.

The upper connecting rod-ram assembly is unitized for precise alignment in conjunction with the crankshaft and die bed. Wear is minimized and opera-

The best way to solve your cylinder problems is to discuss the problems with your O-M Field Representative in your own plant or office.

Whether you are using air or hydraulic power, your O-M Field Representative can be of valuable assistance to you. His broad experience with cylinder applications and installations qualify him to recommend the air or hydraulic cylinder best suited to your particular application.

Ortman-Miller offers you the full facilities and resourcefulness of its Field Organization and Engineering Staff without cost or obligation.

Call the representative nearest you, or use convenient coupon below.

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J. NEILL ARMSTRONG, INC. — *Westmont, New Jersey*
BECKETT-HARCUM CO. — *Wilmington, Ohio*
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HACKETT BROTHERS, INC. — *North Manchester, Indiana*
KNOX, INC. — *East Walpole, Mass.*
H. D. MacRAE — *Rochester, New York*
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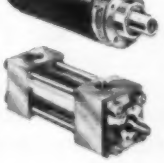
P. W. RICE — *Cleveland, Ohio*
THE RODEN COMPANY — *Cranford, New Jersey*
H. U. ROGNESS, INC. — *Minneapolis, Minnesota*
THE RUCKER COMPANY — *Oakland, California*
ROBERT TAYLOR & SONS — *Salt Lake City, Utah*
WOMACK MACHINE & SUPPLY CO. — *Dallas, Texas*
ZOPF ENGINEERING CO. — *Kansas City, Missouri*



O-M tie-rodless (Round Line) air and hydraulic cylinders — rated to 500 psi Air; to 1500 psi Hydraulic.

Series TH (Square Line) hydraulic cylinders — rated to 2000 psi.

Both lines of cylinders are available in complete range of sizes (1½" to 8" bores) with standard or oversize rods.

ORTMAN-MILLER MACHINE CO.
13 143rd Street, Hammond, Indiana

- ☐ Have Field Representative call
- ☐ Send Bulletin 105 (Square Line)
- ☐ Send Bulletin 101A (Round Line)

Name _____ Position _____
Company _____
Address _____
City _____ Zone _____ State _____

INDICATE A-10-151-2

VULCAN Vairloy, used by Algonquin Tool & Mfg. Co., Chicago, makes dies with negligible distortion in hardening, that produce 100,000 TV bases per grind.

Solving troublesome problems

Here's another good reason why Vulcan tool steels are ahead—for present Vulcan customers and *for you.*

Algonquin Tool and Mfg. Company had a problem of making dies with absolute minimum distortion in hardening. Results were outstanding—heat treat distortion was negligible—close tolerances were met with a minimum of grinding after hardening—tools gave 100,000 stampings per grind.

If you have a tool steel or die problem—look ahead to Vulcan. A representative is nearby.

Vulcan Crucible Steel Division

HKP

H. K. Porter Company, Inc.

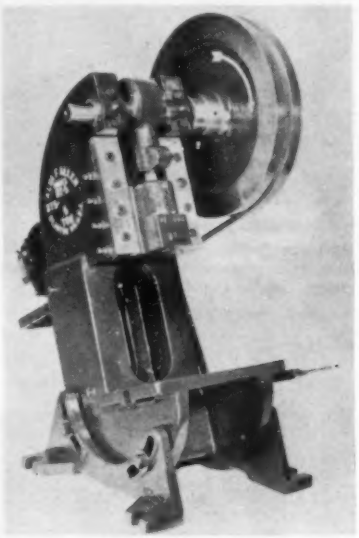
Aliquippa, Pennsylvania

Offices and warehouses in Pittsburgh, Newark, Cambridge, Baltimore, Birmingham, Buffalo, Detroit, Lansing, Chicago, Milwaukee, St. Louis, Paterson (N. J.), Bridgeport

FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE A-10-152

tion is smooth. Ram can be easily adjusted for die setting with standard wrenches. Straight ram guides, 6 ft long, assure alignment of ram at all times with easily adjusted flat side gib for takeup of wear.

Synchronized, positive, single-pin, quick-acting, repeat or nonrepeat clutch



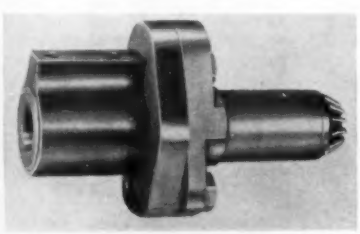
is of simplified construction, with few operating parts.

Standard stroke is 1¼ in. with ¼ to 2-in. strokes available at an additional charge.

Alva Allen Industries, Clinton, Mo. **T-10-1521**

Turret Drill Attachment

This turret drilling attachment can be adjusted to drill holes in the end of bars either on or off center within the capacity of the machine on which it



is used. Three standard sizes are available: ⅝, ¾, and 1 in. diam shanks.

The drive is transmitted to the spindle by a shaft through the turret, which in turn receives its drive from a pair of bevel gears mounted in the center of the turret.

R and L Tools, 1825 Bristol St., Philadelphia 40, Pa. **T-10-1522**

Furnace with Removable Electrodes

Salt bath furnace is designed to permit removable type submerged electrodes to be changed in an hour, even before the molten salt has solidified. The electrodes are fabricated of non-critical alloys and enter the pot from

over the top instead of through the back wall of the casing. Hence, there are no openings below the surface of the salt. An easily removable tile over each pair of electrodes seals off air, preventing oxidation attack on the electrodes.

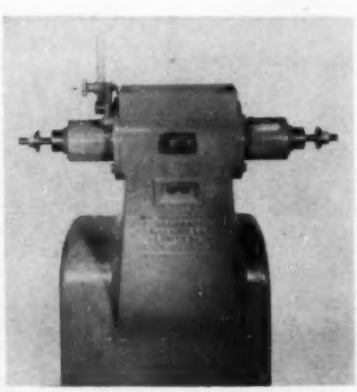
Ajax Electric Co., 970 Frankford Ave., Philadelphia 23, Pa. **T-10-1531**

USE READER SERVICE CARD ON PAGE 167 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

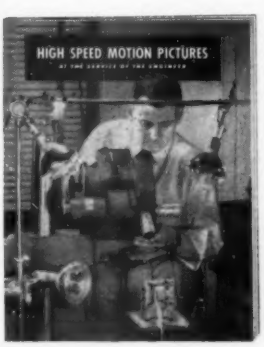
Polishing Lathe

High-speed polishing lathe, with shortened spindle for hand finishing small parts, uses a 5-hp motor and has a speed up to 6500 rpm.

The new model 5-Rol has dynamically balanced, ball-bearing spindle, with either flat or multi-V-belt drive, and motor mounted inside heavy cast-iron base. Drive belts can be replaced without removing or exposing bearings. The



Everyone working on design and performance problems of fast mechanical motion should have a copy of "High Speed Motion Pictures at the Service of the Engineer," a new booklet obtainable without charge from . . .



It tells about the new fast films for high speed movies and how various industries are using the Kodak High Speed Camera.

Kodak
TRADEMARK

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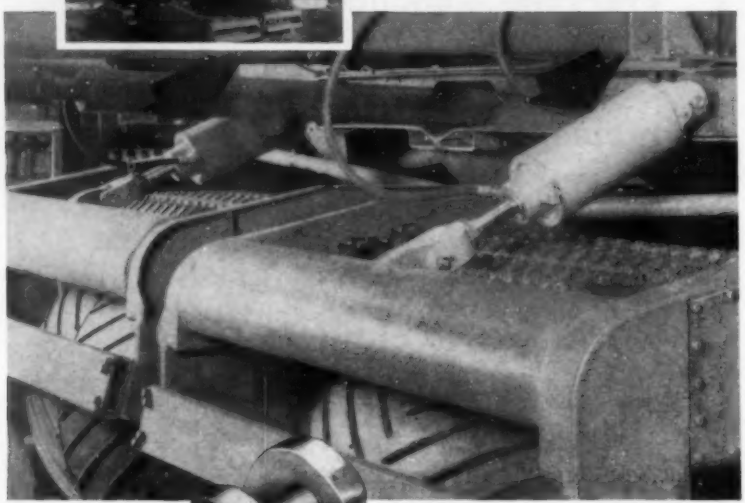
Arctic Cargo Carrier Depends On T-J Spacemaker CYLINDERS

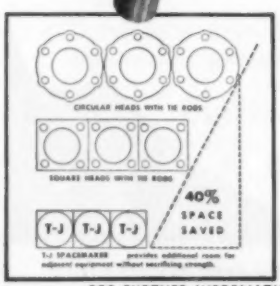


ALL MODELS... OFF SHELF DELIVERY

Saves 40% Space No Tie Rods... Greater Strength

Differential axle loading through T-J Spacemaker Air Cylinders forms a controlled walking beam in this Tera-cruiser, designed and produced for the Army Ordnance Corps by the Four Wheel Drive Co., Clintonville, Wis.

Weight of cylinders was important factor in choosing T-J Spacemakers, which reduce weight while providing same displacement and extra high safety factor. Fast delivery and space-saving features also favored T-J. Exclusive with T-J are new Super Cushion Flexible Seals for Air (to 200 P.S.I.) . . . and New Self-Aligning Master Cushion for Oil (to 750 P.S.I.). Hard chrome plated bodies and piston rods are standard, at no extra cost. Wide range of styles, capacities . . . 64,000 combinations *off the shelf!* Write for bulletin SM-155-3. The Tomkins-Johnson Co., Jackson, Mich.



MEETS WITH ALL JIC RECOMMENDATIONS

T-J TOMKINS-JOHNSON
BUILDERS OF AIR AND HYDRAULIC CYLINDERS CUTTERS CLINCHERS

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unit has a combination brake and switch operated by a single lever. The switch cuts off motor current before the brake is applied. Brake also locks spindle for wheel removal. Overhanging base permits handling of parts without base interference.

Hammond Machinery Builders, Inc., 1661 Douglas Ave.. Kalamazoo, Mich. **T-10-1541**

Port Contour Cutter

Standard, carbide-tipped port contour cutter cuts the internal O-ring boss for straight thread tube fittings. It has four flutes which form the complete contour as the tool is fed into the drilled hole. The flutes are tipped with carbide to provide long cutter life and a maximum

number of cuts per grind. Bushing-type pilots can be replaced or resized by changing the bushing.

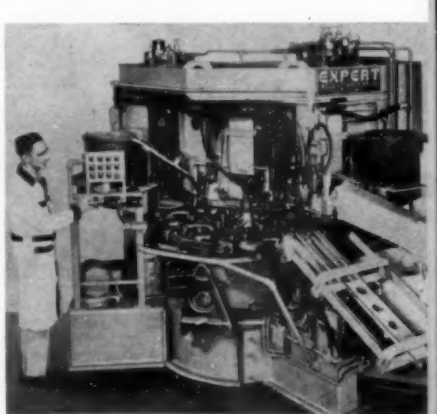
The cutter is available in thirteen diameters for all sizes of fittings used with ⅛ through 2-in. diam tubing. The eight most popular small sizes are available as a set, packed in a tool crib storage box.

Sonnet Tool & Mfg. Co.. 578 N. Prairie Ave., Hawthorne, Calif. **T-10-1542**

Index Welder

Seven-station rotary index projection welding machine with automatic features is designed for accurately positioning and welding nuts or brackets to surfaces of production parts.

A stop-and-start cam drive mechanism



controls index and weld sequences. Bowl feeders are equipped with hopper feed tracks, while a transfer device delivers weld nuts to the projection welding guns. An air-powered unloader mechanism automatically removes the finish-welded assemblies from the machine and deposits them on a conveyor. The motor-driven machine is electrically controlled and air-operated.

The model illustrated projection welds two tee nuts, three weld nuts and a steering stop bracket to automotive suspension arm assemblies at a rate of 400 per hour.

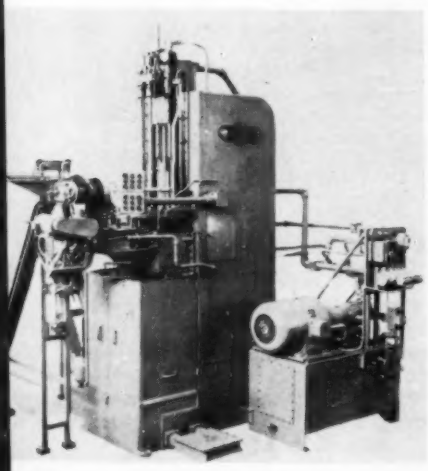
The unit has a 60-in. diameter table, is 8 ft high and occupies a floorspace about 9 x 10 ft. Power for the cam drive is supplied by a 1½-hp electric motor. Welding current is supplied by four 65-kva and two 100-kva transformers.

Expert Welding Machine Co., 17144 Mt. Elliott Ave., Detroit 12, Mich.

T-10-1551

Pull-Down Broaching Unit

Maximum tooling flexibility and easy maintenance in vertical, internal broaching applications is provided by this pull-down machine. It is electrically controlled and all components are interlocked to provide continuous automatic operation.



Hydraulic systems are self-contained and are located outside the machine column. Large worktable provides rigid support with minimum deflection for simple tooling, as well as for the dial index type unit shown. Hinged splash guards under the table open completely to give clear access to broach puller assembly and coolant sump. This machine can be tooled with radially locked pullers, hydraulically actuated and electrically interlocked to the machine cycle. A further electrical interlock can be mounted on the retriever unit, which assures proper positioning of broaches in the retriever heads during the broaching stroke. Retriever unit is mounted to provide correct broach alignment support through the major portion of the broaching stroke.

The machine adaptation shown is an American PD-5-25-54, 25-ton, 54-in. stroke unit, tooled for broaching the 1½-in. inside diameter of 5⁹⁄₁₆ in. long steel sleeves, two at a time. The dial type index unit on this machine has 8 stations—four 2-station workholders, and four 2-station broach return passages. With a 24.0-second cycle, at 100 percent efficiency, production rate on this part is 300 per hour.

American Broach & Machine Co., Ann Arbor, Mich. **T-10-1552**

Air Pressure Regulator

Exact pressure control with maximum air flow is provided by this 2-in. pilot-controlled, high-capacity, Model 20AA-16 air pressure regulator. It provides air control over a wide operation range, and reduces line pressures of up to 400 psi to woking pressures of from 2 to 125 psi. Its temperature range is from 200 to –40 F.

Valve construction is balanced to insure accurate pressure control, minimizing the effect of a fluctuating primary pressure. It has high air flow capacity with large unrestricted air passages and a large diameter valve seat.

Control medium is provided by a pressurized chamber. Remotely controlled, it can be installed at any point in

Here's the final touch for a close tolerance job...
INDIA & HARD ARKANSAS OILSTONE FILES
These outstanding precision tools assure highly accurate results no matter how intricate the surface, or how tough the material. Try them on your tools, dies and parts. INDIA for regular work. HARD ARKANSAS for superfine finishes.
WRITE FOR THIS NEW HAND STONING HANDBOOK
It contains illustrations and descriptions of the complete Behr-Manning Oilstone Line. Address Behr-Manning Co., Troy, N. Y., Dept. TE-10.
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You can choose from a selection of 35 shapes and 97 sizes.
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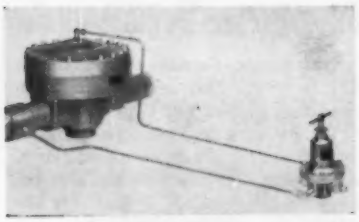


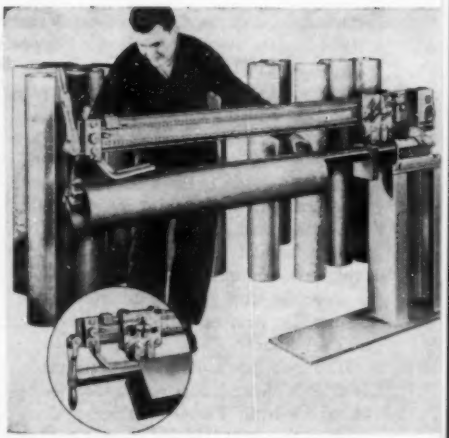
the air system. The pilot regulator can then be installed in any convenient location.

C. A. Norgren Co., 3400 S. Elati St., Englewood, Colo. **T-10-1561**

Universal Power Grooving Unit

Designed for accuracy, speed and operating ease, this Model No. 48-U Universal power grooving machine features a multipurpose horn which can be easily rotated and locked in any one of several positions for closing single-lock seams on inside or outside of square and round work, or Pittsburgh-lock seams on square work.

Driven by a direct connected gearhead motor, the machine requires low horsepower and no belts or guards. Adjustable stops hold work stationary on the horn, and adjusting wheels enable close regulation of roll pressure to conform with thickness of material.



With a nominal working length of 48 in., the machine has a single-lock capacity of 20 ga mild steel and a Pittsburgh-lock capacity of 18-ga mild steel.

Operating controls are located at both ends of the machine. An endless chain drive returns the carriage to starting position automatically. Six models can be obtained with working lengths from 4 to 10 ft for handling mild steel up to 16 ga.

Niagara Machine & Tool Works, 683 Northland Ave., Buffalo 11, N. Y. **T-10-1562**

The new concept of vertical measurement is here
Webber Micro-Accurate
OPTICAL HEIGHT GAGE
This revolutionary new instrument will make micro measurements in the 1" to 61" range with an hitherto unknown overall accuracy of ± .000005" per inch.
These fantastic measurements are made speedily and easily by the average skilled workman.
Next to your Gage Blocks the new Webber Optical Height Gage will be the most useful tool in your shop. There is nothing like it in all the world.
Webber GAGE CO.
12908 Triskett Rd., Cleveland 11, Ohio
Webber Micro-Accurate Gages
LARGEST EXCLUSIVE MANUFACTURER
OF PRECISION GAGE BLOCKS

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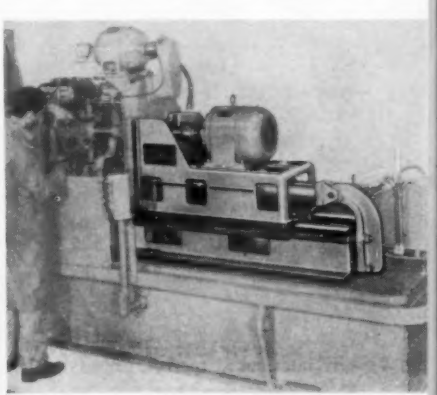
Hydraulic Feed Units

Standard Series 20-400 and 20-401 horizontal and vertical-way type hydraulic feed units are offered as components for production machines. They are designed to provide thrust above the ways near the tool load, thus allowing positive control of rapid trav-



erse, feed and depth. Depth will repeat within 0.0005 in. A flange simplifies mounting and aligning of multiple spindle heads. The 15-in. stroke assures ample tool change clearance.

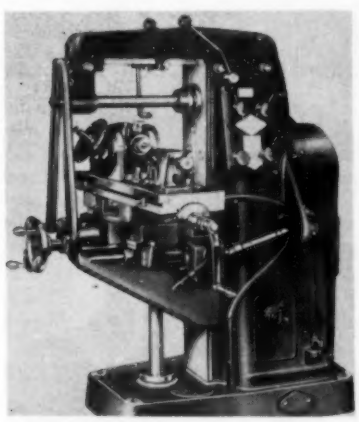
The power cylinder is mounted above the ways, and the hydraulic control panel can be mounted on either side of the unit. A separate floor type power pack supplies hydraulic power in compliance with JIC standards. The unit develops a maximum thrust of 12,000 lb. Feed rate is infinitely adjustable from 0 to 24 ipm.; rapid advance is 8 ips. Multiple-spindle drive motors up to 20 hp can be mounted on the saddle.

The Hartford Special Machinery Co., 280 Homestead Ave., Hartford 12, Conn.

T-10-1571

Milling Machine

Pedersen Model VPU-O milling machine is built for average capacities. Standard feature of the machine is that it feeds in three directions. Other automatic features normally found on heavier milling units are also incorporated in this intermediate machine.



Distributed by Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.

T-10-1572

Anchoring Device

This adjustable anchor incorporates principle of a differential screw jack to provide an anchoring device for setting and leveling any type equipment. It was particularly designed for conditions requiring unusual ranges of adjustment, powerful jacking or hold-down actions, or adjustment of equipment elevations without unbolting or taking the equipment out of service.

The device, which is composed of five parts—stator, sleeve, rotor and two

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Jarvis PIPE TAPS WITH STANDARD HAND TAP SHANKS!

Here's the answer to the problems presented by conventional pipe taps! Exclusive Jarvis Pipe Taps with standard hand tap shanks easily fit any tapping machine or device—with never a chucking bottleneck. This addition to the dependable Jarvis line of standard taps affords new tapping versatility and precision.

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Complete manual with tap data and tips for better tapping is yours for the asking!

Here's the big advantage of Jarvis taps with Standard Hand Tap Shanks—

	¼"—18 N P T Standard Pipe Tap	¼"—18 N P T New Jarvis Pipe Tap
Shank dia.	.5625	.480
Square size	.421	.360
Overall lgth.	2⅞"	3⅛"

Three other sizes are stocked—⅛", ⅜", ½"—and all save man-hours, production dollars.

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locking rings—can be installed in or on concrete, or welded or bolted to steel bedplates, columns, etc. The anchors can be used individually or in complete sets or clusters. They can be installed either before or after concrete has been poured. They are equally effective when installed on floor, wall, ceiling, or other type installations within formwork.

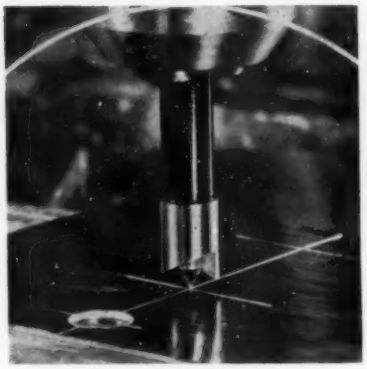
The anchors are available in two sizes. Size 1 weighs approximately 4 lb, is 2 29/32 in. in diam across the top and is 1¾ in. high. Size 2 weighs about 10 lb, is 4⅝ in. in diam across the top and is 2¼ in high.

Adjustable Anchor Corp., 720 Goethals Dr., Richland, Wash. **T-10-1581**

Drilling Tool

Precision drilling of thin lightweight materials of 0.001 in. to 10 ga is effected by a boring tool called Roto-Bor. Precisely sized, round holes can be drilled in sheet steel, aluminum, brass, copper, hard rubber, rigid plastics, hard boards, paper or cardboard.

The Roto-Bor cuts from the outside of the circle in, instead of by the conventional inside-to-outside method. Accurate holes without distortion and almost burr-free are made with either portable or stand drills at drill-press speeds. Because no appreciable torque is developed by the cutting process, work may be held by hand.



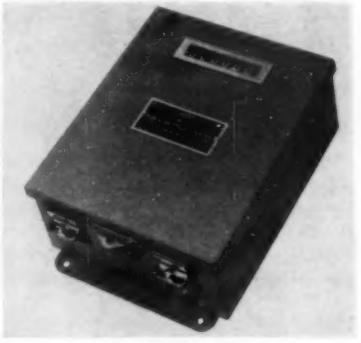
An axially retractable center point, which facilitates accurate positioning, is removable for easy resharpening of the tool.

Roto-Bor is available in single tools or sets in sizes 1/32 in. over standard from 3/16 to ¾ in. and in specials from ⅞ to 1¼ in.

Jancy Engineering Co., Davenport, Iowa. **T-10-1582**

Load Cycle Counter

Only work or operations actually performed are counted by this telemetering load cycle counter which differentiates between idling, dry run and load cycle and counts only the load cycle. It is actuated by sensing the current flow to electrically driven machines (such as presses, broaches, drills and mills) or electrically powered operations (such as tempering or welding).



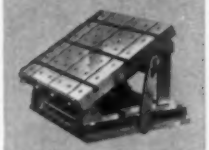
The unit is adaptable for accurate proximity or impact counting. It can also be used as a warning and/or counting instrument. The telemetering feature permits simultaneous counting at the machine and at a remote location such as a production control center.

This new load cycle counter eliminates the inaccuracies of mechanical "no-load" counts and the necessity for physical counting. It gives a depend-

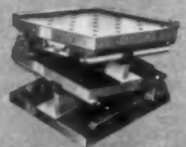
1ST

Your First Choice
FOR ANGULAR TOOLING.... ROBBINS!

"Magna-Sine" Magnetic Sine Plates for precision set-ups grinding single or compound angles.



Heavy Duty Sine Plates for angular machining. Wide variety of sizes. 12" square model shown.



Inspection Sine Plates for precision inspection and light machining on single or compound angles.

A look at the record shows exactly why Robbins equipment for angular tooling should be your first choice! Here's the record:

1ST to originate the idea of a simple sine plate for faster angular toolroom set-ups—*1936*

1ST to build these as a standard product for general distribution—*1936*

1ST to build a non-magnetic sine plate designed specifically for precision inspection —*1946*

1ST with a permanent magnet chuck—*1948*

1ST heavy duty sine plate for angular machining—*1954*

1ST *and the only one with* the exclusive "PERMA-FLAT" SWIVEL BLOCK—*1956*

Robbins is the only sine plate manufacturer with a complete line of sine plates for every angular set-up problem in precision machining, grinding and inspection. We also offer complete engineering and manufacturing facilities for the solution of special problems, and are now building high-production automatic assembly and other special machines. Send for sine plate literature, or send us details of your requirements in special machinery.

OMER E. *Robbins* COMPANY
24800 PLYMOUTH ROAD DEPT. E DETROIT 39, MICH.
Also manufacturers of special machinery, automatic assembly machinery.
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-158

able count of work actually produced.

The mechanism is sealed in a dust-proof, tamper-proof and locked box. Access to reset dial and single adjusting knob for setup changes is by key.

It is available with resettable 6-digit counter in speeds up to 1000 counts per minute. It is supplied standard, JIC or NEMA 12-8 x 10 x 4½ in.

Ram Meter, Inc., 1100 Hilton Rd., Ferndale, Detroit 20, Mich. **T-10-1591**

Torque Thumbscrew

These torque thumbscrews are designed to prevent dust, chips, and other foreign matter from getting into the head release mechanism. A knurled ring is held to the body of the torque thumb-

screw with a Truarc ring, resulting in a dust-tight head, while permitting disassembling for cleaning.

This head design is available on regular, adjustable, tee head and inverted models.

Vlier Engineering, Inc., 8900 Santa Monica Blvd., Los Angeles 16, Calif. **T-10-1592**

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Automatic Size Control

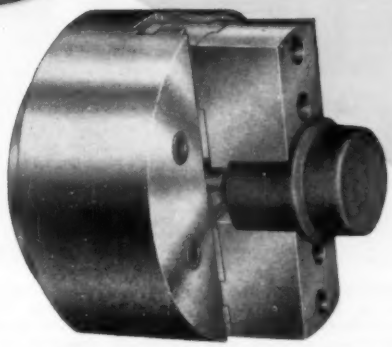
Accurate stock removal is achieved with this continuous proportional automatic size control unit.

Illustrated is a centerless rough-grinding operation on a bearing race OD. With an average stock removal of 0.010, part size is held within ± 0.002. With this control method there is no sawtooth pattern.

The unit measures every piece, and the setting of the operating machine is influenced by the size deviation of each part. Thus, adjustments are frequent and are never large.

Basically, the control consists of a transducer gaging head, amplifier, and servo-driven transmission. In the illustration, parts coming from the machine

SP POWER CHUCKS



for more gripping power–
higher production

Famous S-P cam and lever design holds the work tighter, permits cost cutting heavy feeds and multiple cuts. S-P cam and lever design also resists opening of jaws by centrifugal force or diminishing air pressure . . . an important safety factor. Balanced for high rpm.

S-P SELF-CENTERING CHUCKS are built in Universal American Standard models, sizes 6" — 8" — 10" — 12", and Serrated models in 8" — 10" — 12" sizes. Two or three jaws.

S-P COMPENSATING CHUCKS grip out-of-round work with equal pressure on each jaw. Available in 8" — 10" — 12" sizes, two and three jaw models, American Standard or Serrated.

S-P ROTATING CYLINDERS
Air and Hydraulic

Adequate stroke for long jaw travel of S-P Chucks. Balanced for high rpm on machine tools and other applications. Details in Catalog No. 105 (Air) and Bul. 201 (Hydraulic).

S-P Power Chucks are installed as original equipment by Bardons & Oliver, Cleveland Automatic, Cone Automatic, Ex-Cell-O, Jones & Lamson, Monarch, Warner & Swasey . . . and many others. Representatives in principal cities. Prompt deliveries. Send for catalog No. 105. The S-P Manufacturing Corporation, 30201 Aurora Rd., Solon, Ohio.

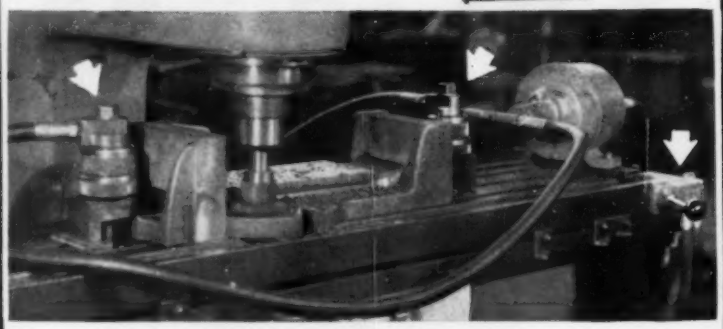
SPecify SP

THE S-P MANUFACTURING CORP.
SOLON, OHIO • IN GREATER CLEVELAND
ESTABLISHED 1916 A BASSETT COMPANY

NON-ROTATING AIR AND HYDRAULIC CYLINDERS • ROTATING AIR AND HYDRAULIC CYLINDERS
POWER CHUCKS • COLLET AND DRILL PRESS CHUCKS • AIR PISTONS, VALVES, ACCESSORIES

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-159

PowRlock gives this hand a 6000 lb. GRIP!



PowRlock AIR-HYDRAULIC CLAMPS provide instant automatic clamping on most existing machines and fixtures. Eliminate nuts, bolts, manual tightening, slash "reloading" time. Hydraulic pressure in the head activates a piston, which exerts up to 6000 lbs. locking force at one to 4 points. Comes complete with air-hydraulic system in 14 models. UNCONDITIONALLY GUARANTEED!

ATTACH THIS AD TO YOUR LETTERHEAD FOR FREE DEMONSTRATION OR LITERATURE.

WILTON TOOL MFG. CO., INC.

SCHILLER PARK, ILLINOIS

Sold By Leading Distributors The World Over

TE-10

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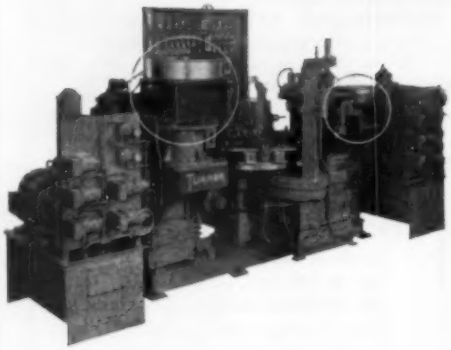
SYNTRON VERTICAL-VIBRATORY

PARTS FEEDERS



will increase capacities of indexing tables centerless grinders placing devices speed marking dies, etc.

Positive, finger-tip control of feeding rates plus ability to handle small parts of nearly any material or shape enables Syntron Parts Feeders to cut production costs and increase capacities of countless automatic processing installations. Electromagnetic—no mechanical wearing parts—easy to install.

For more information on how to cut production cost and increase capacities with Syntron Parts Feeder write for catalogue data Free.

SYNTRON COMPANY

340 Lexington Ave. Homer City, Pa.

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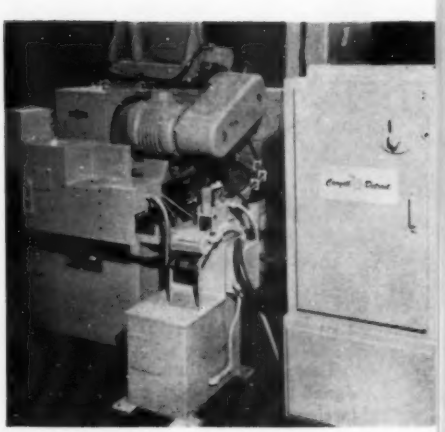


are fed thorugh the gaging head by an auxiliary feed mechanism. For multiple-machine through-feed applications, the gage head is mounted in line on the parts conveyor. An optional size sorting mechanism directs the sized parts to different chutes.

Cargill Detroit Corp., 2254 Cole Ave., Birmingham, Mich. **T-10-1601**

OBI Press

Die space of 12 in. (from bed to slide with stroke down and adjustment up) is designed into this 15-ton Rousselle OBI press, built for heavy, continuous production.

The unit, Model No. 2E, is engineered

for simplified operation, minimum maintenance and accuracy and uniformity of press runs.

Adjustable ram guides maintain true alignment. Large bearings are easily replaced when necessary. Clutch mechanism is oversize and can be set for

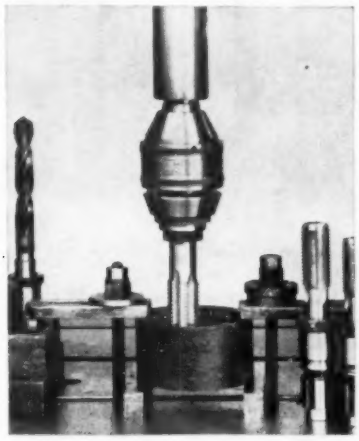
single stroke or continuous operation. To facilitate setup adjustment, unit is equipped with roller bearing inclinable device.

Service Machine Co., 2310 W. 78th St., Chicago 20, Ill. **T-10-1611**

Tapping Attachment

Jay-Dee universal attachment will safely drive any size tap to the bottom of a blind hold, release and allow reversal of the spindle. Driving torque for each tap is predetermined and no adjustments are necessary.

The attachment employs a series of adapters or collets, each of which holds a different size tap. Adapters are easily



and quickly changed in the same manner as for any conventional chuck. Adapters for holding other taper shank tools also are available.

When torque required to drive a tap exceeds the predetermined amount above which the tap shank may break, a design feature causes the clutch to ride up in safety until the spindle is reversed.

Distributed by Federal Machinery Sales Co., 4639 Washington Blvd., Chicago 44, Ill. **T-10-1612**

Air Pressure Hydraulic Valve

Hydraulic 4-way valve is air-pressure operated by air pilot valve. The arrangement permits use of the hydraulic valve automatically when the air pilot valve is controlled mechanically.

The Model 5950 valve is available in standard action, spring-return and spring-centered. With spring-return valve, the piston is moved to original position when pilot pressure is drained off. It requires one air pilot line for remote operation in one direction. On the spring-centered valves, air pilot lines to each end of valve are required for remote operation in either direction, and when both pilot pressures are drained off, the piston is spring-centered.

Designed for 1500-psi pressure, the new hydraulic valves are offered in 7 sizes: ¼, ⅜, ½, ¾, 1, 1¼ and 1½ in. Spring-centered valves are available in 5 piston designs to meet the requirements of any hydraulic circuit. Standard action and spring-return action valves are available in a single piston design.

The 4-way hydraulic valves feature a simple "floating piston" design to assure leakproof operation and provide positive opening and closing. Ring seals on the stem reduce friction.

Rivett, Inc., Brighton 35, Boston, Mass. **T-10-1613**

Hydraulic Trim Press

A 3-hp motor operates this compact, high-speed, 20-ton hydraulic trim press designed primarily for the die-casting industry. The press is engineered around the parallel strain rod, guided platen principle. With special electrical and air controls, and its hydraulic circuit, it is quiet and practically shock-free in operation. All connections to power, air and water are made at the top of the machine.

Platen design permits knockouts to be provided between the ram and platen, and clearance holes for use of standard punch-press dies. Nondeflecting characteristics and long parallel bearings stabilize the platens, and the press can be fed as fast as the operation necessitates. Die setup and tryout are

what's going on at MARVEL?

1. A NEW BUILDING PROGRAM...

Not long after you read this, we will have completed the MARVEL plant expansion program which will *double* our already considerable manufacturing space. MARVEL'S confidence in the future and its continuing development, coupled with the increasing demand for MARVEL Hack Saws, Band Saws and Hack Saw Blades, makes this expansion mandatory.

2. A NEW "SUPER" BAND SAW

In our enlarged plant, we will demonstrate for the first time, a completely new, heavy duty, all-hydraulic, fully universal MARVEL Band Saw designed especially for High Speed Steel Band Saw Blades. This new "Super" Band Saw is heavier, more powerful and rugged than any band saw yet available. It incorporates a great many new and exclusive design and operating features to make it the most advanced Band Saw for BOTH high production and universal work.

3. AN INVITATION TO "TRY" BEFORE YOU BUY

One or more of the new Band Saws will be set up in our new plant, together with new, improved MARVEL Hack Saws, to demonstrate comparative performance on a wide variety of work. We will also set up specific cutting-off jobs requested by customers or prospective purchasers on *both* types of machines and arrange to have interested personnel observe and check the demonstration of comparative saw performance *on their own work.*

What better way is there to prove to yourself the speed, accuracy, efficiency and economy of MARVEL Saws and to select the right type of saw (hack saw or band saw) to best fit your individual job requirements?

FC—1700

ARMSTRONG-BLUM MFG. CO.
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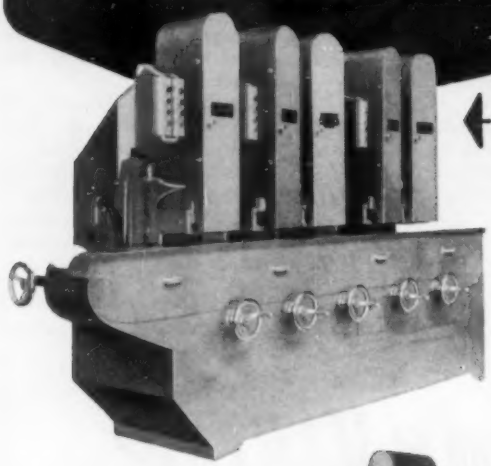
MARVEL Metal Cutting SAWS
Better Machines · Better Blades

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-161

Double Production

by grouping several operations on one

Engelberg Abrasive-Belt Grinder!



MODEL 680-5

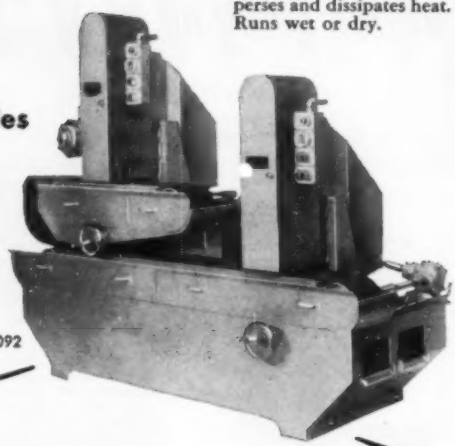
Multiple-Head Grinder Available up to 6 Heads

Single-cycle grouping on 5-headed machine above might include: deburring, flat-surfacing, sizing, polishing and fine polishing. Stock removal is at high speeds. Large grinding area, long belt disperses and dissipates heat. Runs wet or dry.

For Grinding Both Sides of Flat Work

Piece-work first passes under grinding head at left, then is carried around bend to bottom conveyor belt. Unground face is now *up*, positioned for passage under second grinding head at right.

Model 2-1092



PRODUCTION INCREASES OF 100% AND UP are not uncommon with the high-production semi-automatic abrasive-belt grinders shown here. Fine finishing to close tolerances may be done on *any* ferrous or non-ferrous metal, plastic or other material.

Precision manufacturing of these and scores of other models has provided facilities and experience ideally suited to the solution of problems in abrasive grinding. Our methods-engineers will gladly go over your drawings or samples of typical production pieces for operational analysis—no cost or obligation. Just write.

The ENGELBERG HULLER Co., Inc.
309 Seneca St., Syracuse, N. Y.

See the newest ENGELBERG Models at the METAL CONGRESS SHOW—BOOTH 2746

ENGELBERG PRECISION ABRASIVE-BELT GRINDERS

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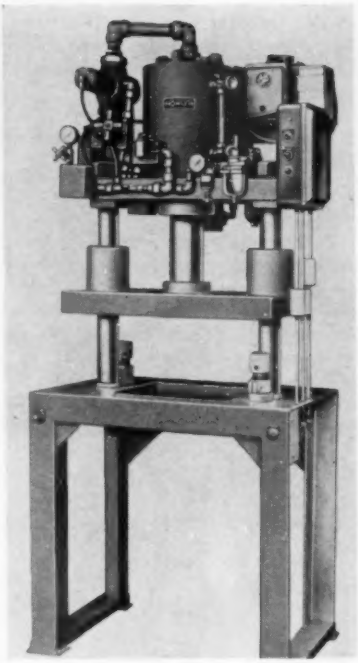


easily accomplished. The unit also can be used as a dwell press.

Ram travels at high speed in either direction. Cylinder and ram design avoids galling and scoring. Press operates at speeds in excess of 600 ipm free ram travel and at reduced speeds during trimming, shearing, forming and drawing operations. Stroke is adjustable from 0 to 12 in. with a shut height of 17 in. The upper platen has an 18 x 24-in. free area; lower platen has a 15 x 15-in. cutout which can be eliminated or varied. Working area between the uprights is 23 in. Additional controls are available for selecting ram speeds of 0 to 40 ipm during pressing operations. Upclosing rams are also available for double pressing action or when ejection operations are required.

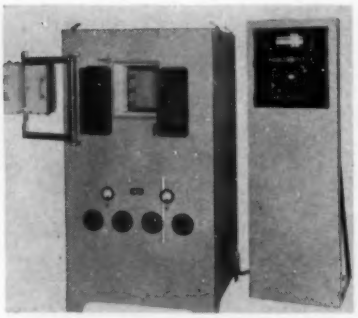
Electrical controls are so designed that they can be easily and quickly changed from manual to full automatic.

The Mohler Engineering Co., 33 Roetzer St., Buffalo 11, N. Y. **T-10-1621**

High-Temperature Electric Furnace

This series of electrically heated furnaces for heats to 2500 and 2750 F uses special silicon-carbide nonmetallic heating elements. There is wide selection of voltage adjustment.

Door openings are always the specified height and width of the firing chamber. Dimensions are not altered by addition of baffles in the interior of the furnace. Baffles can be installed to re-



duce the effects of radiation from the heating elements.

Case construction is of heavy sheet steel. All units are of floor type construction and transformers, contactors and temperature controls (except for special controls which require a special instrument panel) are installed in the base of the unit. Special controls are available for critical heating procedures.

Insulation is multilayered type.

L & L Mfg. Co., 136 Eighth St., Upland, Del. Co., Pa. **T-10-1631**

USE READER SERVICE CARD ON PAGE 167 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Draw Press

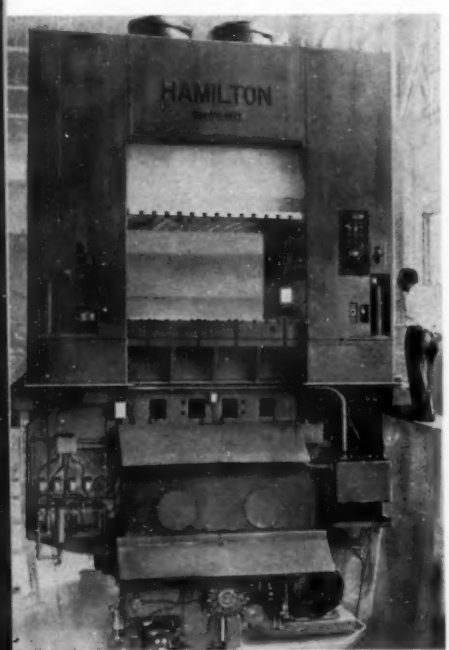
This welded-steel, under-drive mechanical draw press incorporates the operating mechanism in the press bed to facilitate inspection and maintenance. Swivel arrangement of counterbalance cylinders permits them to align properly when the gibs are adjusted.

Features of the design include Double-Lube system to provide both automatic and gravity-flow lubrication to all bearings; eddy current clutch; piping and wiring enclosed as a package within the press structure to speed up installation and protect against damage; and safety die blocks and die lights. Only piping and wiring need to be connected to plant power services.

The new presses are available in sizes from 500 to 1000-ton capacity with beds of from 84 x 72 in. to 200 x 100 in. Various cycle sequences may be obtained. The press may have a fast advance and return, and still maintain a safe drawing speed.

Hamilton Press Div., Baldwin-Lima-Hamilton Corp., Hamilton, Ohio.

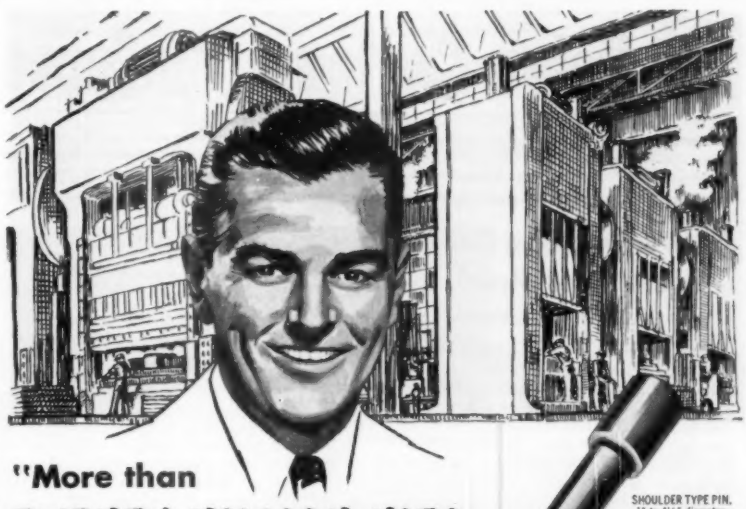
T-10-1632



Brazing Alloy

Silver brazing alloy in the form of expanded-and-rolled strip offers considerable weight-reduction advantages. Expanded strip may weigh less than ⅛ as much as solid strip of the same cross-section thickness. Any of the brazing alloys normally supplied by Handy & Harman in strip form are available in the expanded form.

Because of the high fluidity of molten silver alloys, the expanded strip will flow and wet the joint faces uniformly despite the interstices in the grid pattern. This is true for both continuous joint faces and honeycomb structures so that maximum joint strength and uniform bonding will be obtained regardless of the alignment between the grid of the alloy and the edges of the honeycomb. The only requirement is that the



"More than
TWENTY MILLION HITS
since we changed to Lamina Guide Pins and Bushings!"

"Since changing to Lamina Guide Pins and Bronze-plated Bushings on our dies, they have run more than 20,000,000 hits . . . and they're still going! Formerly, the best we could get was 4,000,000 to 5,000,000 hits on any make." *This is a typical quotation from an actual user letter.*

Lamina bronze-plated wring-fit bushings are pre-finished on the I.D. Seated on a shoulder square with the die shoe surface and secured by special retainers, they assure distortion-free, full bearing surface that results in better die alignment, less maintenance and longer die life.

Lamina Guide Pins are special tool steel, heat treated, spray quenched, hardened, ground and burnished. The uniform, hard surface resists wear, while the tough core won't bend in installation or use. These dimensionally accurate pins do not "mushroom" or get out of round, and require no "running in."

There is a size and type Lamina Guide Pin and Bushing for every need. Our new catalog shows illustrations, applications, dimensions and prices of more than 800 items. Ask your die set supplier, or write us for your free copy now.

SHOULDER TYPE PIN. 1" to 4½" diameter. Straight and Removable types also available.

LONG SHOULDER Bronze Plated Bushing contains pin during entire stroke. ¾" to 3" I.D.

NUT TYPE Bronze Plated Bushing for wide range of requirements. 1" to 2" I.D.

Lamina
DIES AND TOOLS, INC.
P.O. BOX 31, ROYAL OAK, MICHIGAN

SPECIAL PINS AND BRONZE-PLATED BUSHINGS for any application . . . tailored to your requirements. Send prints for prompt quotation.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-163

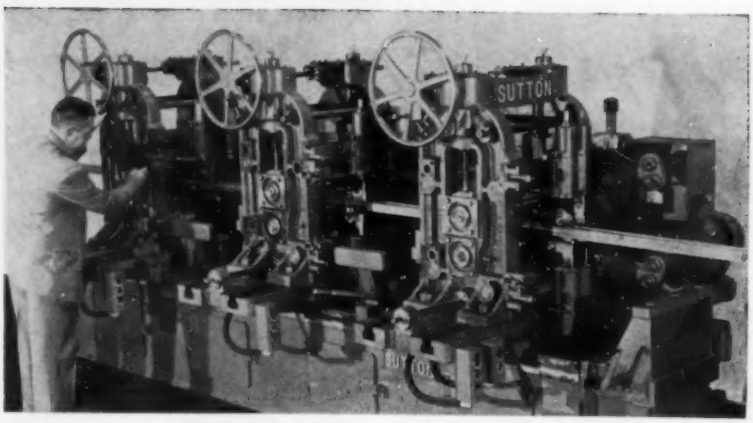
expanded strip be specified to contain a sufficient volume of filler metal to cover the joint area to the thickness normally required.

Handy & Harman, 82 Fulton St., New York 38, N. Y. **T-10-1641**

Contour Correcting and Straightening Unit

Cross-sectional distortions of aluminum extrusions may be corrected economically to close tolerence with this contour correcting and straigthening machine.

Designed for simple change-over to different extruded shapes, the machine uses multiple rolls of simple design. One or more contour correcting stands are furnished with the machine with provision for additional stands to be added. For simple shapes, a single stand can be used. For more complex shapes, two or more stands are desirable to accomplish multiple corrections in one pass.



Sutton Engineering Co., First National Bank Bldg., Pittsburgh 22, Pa. **T-10-1642**

MOORE SPECIAL TOOL COMPANY

Holes, Contours, Surfaces

Published in the interests of greater accuracy and quality in the toolroom and on the production line by the Moore Special Tool Co., Inc., 732 Union Ave., Bridgeport 7, Conn., builders of Jig Borers, Jig Grinders, Panto-Crush Wheel Dressers, Precision Rotary Tables, Motorized Centers and a complete line of Hole Location Accessories.

New 424-page Book Tells How You Can Produce Tools, Dies, Precision Parts the Modern Way

"Holes, Contours and Surfaces" Just Published

"Holes, Contours and Surfaces," just published by Moore, gives all the answers to metalworking's toughest problem: *the accurate locating and machining of holes, contours and surfaces.* It covers the many major developments in the field since 1946 when Moore's first book, "Precision Hole Location," was published. That book became a technical best-seller and is now out of print.

While "PHL" dealt only with jig boring and jig grinding of holes, this new, 424-page volume describes subsequent hole-location developments, covers contours and surfaces, and introduces the subject of linear form grinding. "HC&S" is a must for every toolmaker, jig borer operator, jig grinder operator, machinist, tool engineer, production engineer, machine buyer, machine builder, production executive, product designer, apprentice and student.

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"HC&S Fills Urgent Need" ...Burnham Finney

Burnham Finney, editor of *American Machinist*, says: "HC&S is outstanding for its clarity of expression, its technical accuracy... fills an urgent need."

EXCLUSIVE—184 Pages of Woodworth Tables

"HC&S" includes a 184-page section of Woodworth Circular Tables which greatly simplify calculating rectangular coordinates for locating hole centers on a circular layout. There is a table for each pattern of holes, 3 to 100 inclusive. These tables are not available elsewhere.

495 Photos and Drawings

"Holes, Contours and Surfaces" features a multitude of close-up instructional photographs, working drawings and charts placed adjacent to text so that it can be followed photographically.

Moore Special Tool Company, Inc.
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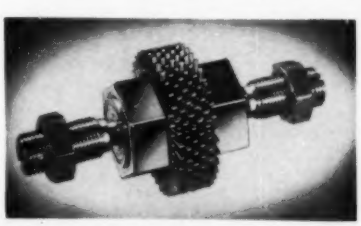
Abrasive Dresser

High-quality, low-cost abrasive dressing is provided by the Type A Wise cutter assembly. It picks, instead of crushes, the surface ofthe abrasive disk.

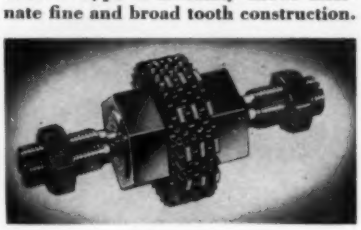
Two available types of cutting wheel assemblies are interchangeable on the same basic arbor. The standard type, with a cutter blade assembly made up of 6 wheels with all fine teeth, is suitable for dressing softer abrasive disks. Type A, which has 3 wheels with fine teeth and 3 wheels with alternate fine and broad teeth, is used for dressing hard abrasive disks.

Because fine teeth on both styles pick abrasive grain from the surface, they sharpen without changing the grinding characteristics. Broad teeth on Type A



Above. Wise type dresser cutter shows standard fine tooth dresser cutter assembly.

Below. Type A assembly shows alternate fine and broad tooth construction.



prolong the life of the dresser cutters.

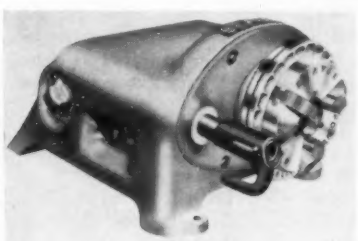
Square design of the Tru-square arbor of the dresser cutter prevents tendency to chew the keyway holding them on the arbor spindle.

Rotation of the cutter assemblies is almost frictionless. Buttons pressed into the side of each individual cutting wheel eliminate need for spacing washers, and speed assembly and replacement.

Besly-Welles Corp., South Beloit, Ill.
T-10-1651

Power Drive

Porto Mite Super Drive, a redesigned Model-D power drive, is available as a power source for threading, grooving and cutting equipment. By utilizing aluminum in the housing and elsewhere in the unit, weight has been reduced by 15 lb. Feature of the unit is the Power



Grip wrenchless chuck which is closed firmly without the use of wrenches. Heavy pipe and tubing as well as light aluminum tubing and plastic can be cut without marring or marking the work.

The switch has been recessed into the side of the housing to avoid accidental starting or stopping of the unit.

Beaver Pipe Tools, Inc., Warren, Ohio. **T-10-1652**

USE READER SERVICE CARD ON PAGE 167 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Countersink Drives

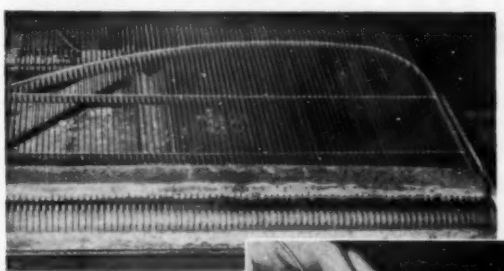
Two drives for chamfering, countersinking and counterboring tools, are especially suitable for automatic and multiple-spindle use.

The drives, called List 340 and List 440 Micro-Limit drives, offer a combination of pretravel and over-travel features, which allow for considerable variation in part thickness, positioning and spindle travel without affecting accuracy of the work done. Depth of cut can be easily preset in increments of 0.001 in. The sleeve, under spring tension, allows ¼-in. pretravel before the tool engages the part. When the preset depth is reached, an over-travel

381 EASY-FLO joints make this completed screen virtually a homogeneous piece. The characteristic trim, neat EASY-FLO joints facilitate the cadmium plating.
Why are jet engine Air Screens brazed with EASY-FLO?

This could be the "$64,000 question" for many manufacturers. For, in many cases, the answer could mean that much and more in time-labor-cost savings over other metal joining methods.

THE ANSWER—proved beyond question by the thousands of metal parts all through industry that are now brazed with EASY-FLO—is this—*the remarkably strong, normally indestructible joints this low-temperature silver brazing alloy makes—at surprisingly low cost.*



Fins assembled in frame for brazing.

The 100 joints at tube end are induction brazed in 10 minutes. Worm gear mechanism draws heating coil through tube. Operator hand feeds EASY-FLO as each joint comes to temperature. H&H B-1 flux is used.

Photos & Data courtesy of THE AID CORPORATION Engineers & Manufacturers Clayton, Georgia

Fins are torch-brazed to stiffeners with EASY-FLO and regular HANDY FLUX. The 381 joints are done with a facility you have to see to believe.

EVERY DESIGN AND PRODUCTION MAN . . . should have the facts about EASY-FLO brazing. They're fully set forth in BULLETIN 20. Write for your copy today.

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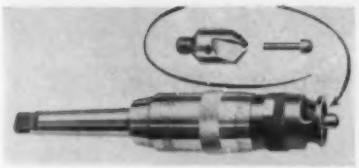

of from ¼ in. (on the 340 drive) to ⅜ in. (on the 440 drive) is provided.

High-speed steel threaded-shank countersinks with insertable steel pilots in 54 different combinations of included angle and pilot size are available from stock for each of the drives; solid-pilot countersinks, special countersinks and counterbores may be had on special order.

Cogsdill Twist Drill Co., Oak Park 37 (Detroit), Mich. **T-10-1661**

Ductility Gage

This cup tester is designed specifically to gage ductility of specimens in thicknesses from 0.003 to 0.062 in. of metals, including copper, brass, aluminum, tin plate, stainless steel and carbon steel.

The gage, designated Model "D," is a bench-mounted hydraulically operated unit. Power is supplied by a compact ⅓-hp motor. Two valves provide infinite control of the testing operation. Depth of cup is shown by a dial indicator which is fitted with a friction brake so that maximum deflection readings are retained until released by the operator. Maximum load at time of yield is shown by red "lazy" hand on load gage.

The ball penetrator is a standard ⅞-in. diameter, and the die supplied with the machine has a standard 1-in. diameter.

While the minimum width for use with a ⅞-in. penetrator is recommended to be 2 in., narrower strip can be tested by using special small-diameter penetrators.

Over-all size of the tester is 11½ x 21 x 25 in. high. Net weight is less than 200 lb.

Steel City Testing Machines, Inc., 8817 Lyndon Ave., Detroit 38, Mich. **T-10-1662**

Extruded Sheet

Extruded copolymer styrene sheet, Campco S-1029, is now available. It provides high impact strength even at temperatures as low as —40 F. high tensile and flexural strength, and relatively high heat distortion point. It also has high resistance to chemicals.

Because the sheet is free from internal strain and is high in strength, it is readily vacuum-formed into complex shapes. With proper technique, deep draws can be formed.

Sheets in sizes up to 9/16 in. thick are available in a wide range of colors.

Campco Div., Chicago Molded Products Corp., 2717 N. Normandy Ave., Chicago 35, Ill. **T-10-1663**

Circular Saw Blade Sharpener

The G-45 blade sharpener sharpens blades from 8 in. through 45 in. in diameter. Prime feature of the unit is its ability to grind alternating high and low teeth with one setting. The high tooth is chamfered on either side, and the following tooth is square. The narrow tooth roughs out the center and the wide tooth finishes the cut. As a result, three curling chips are formed by two

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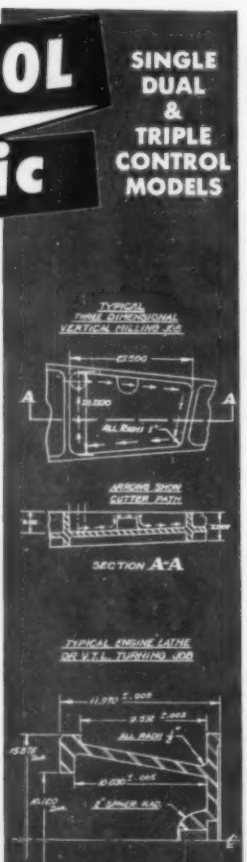
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TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

Literature Number	COMPANY	DESCRIPTION
A-10-203-1	Ace Drill Corp.	**Carbide Drills**—Catalog contains data on Ace ground-from-the-solid drills and hardened H.S.S. drill blanks. (Page 203)
A-10-244	Allegheny Ludlum Steel Corp.	**Hot Work Steel**—Folder "Blue Sheet" contains technical data on Grade B-47 tool steel applications. (Page 244)
A-10-54	American Broach & Machine Co.	**Broaching**—Catalog 450 contains data on broaching operations. (Page 54)
A-10-149	Baker Bros., Inc.	**Special Machines**—Catalog contains data on Baker basic machines. (Page 149)
A-10-314	Balas Collet Mfg. Co.	**Pusher Pads**—Folder contains details on Balas carbide pusher pads and Model "A" master pushers. (Page 314)
A-10-306-1	Barksdale Valves	**Air Valves**—Data on 4-way air valve for 250 psi. (Page 306)
A-10-190	Barnes Drill Co.	**Filters**—Catalog 350G contains data on magnetic coolant filters. (Page 190)
A-10-155	Behr-Manning Co.	**Hand Stoning**—Handbook contains illustrations and descriptions of oilstone line. (Page 155)
A-10-249	The Bellows Co.	**Air Motors**—Bulletin ML-3 gives data on the air motor and hydro check combination. (Page 249)
A-10-196	Besly-Welles Corp.	**Carbide Tools**—Catalogs 851C and 852C contain data on carbide tools, tool holders and throwaway carbide inserts. (Page 196)
A-10-313-2	Bischoff Chemical Corp.	**Coatings**—Booklet contains data on strippable protective coatings. (Page 313)
A-10-252-2	Black Drill Co., Inc.	**Drills**—Manual contains data on "Hardsteel" drill applications. (Page 252)
A-10-275	The Blanchard Machine Co.	**Grinding Wheels**—Third edition of "The Art of Blanchard Surface Grinding" available. (Page 275)
A-10-281	Charles Bruning Co., Inc.	**Optical Tooling**—Measuring and aligning described in booklet on optical tooling. (Page 281)
A-10-224	Brush Electronics Co.	**Identification**—Operational data on new Brush Metal Monitor. (Page 224)
A-10-267	The Bullard Co.	**Special Machines**—Bullard Mult-Au-Matic, Type "L" described in catalog. (Page 267)
A-10-146	Chicago Rivet & Machine Co.	**Rivets**—Catalog contains engineering and rivet specifications. (Page 146)
A-10-177	Circular Tool Co., Inc.	**Circular Saws**—Catalog N contains details on Circle R saws. (Page 177)
A-10-296-2	Comtor Co.	**Precision Gaging**—Bulletin 49 contains operational data on Comtor plugs. (Page 296)
A-10-16	Cone Automatic Machine Co., Inc.	**Automatics**—61 models of Conomatics described in catalog. (Page 16)
A-10-261	Danly Machine Specialties, Inc.	**Die Set Data**—Bolster plate accessories and die makers' supplies listed in catalog. (Page 261)
A-10-66	Denison Engineering Div. American Brake Shoe Co.	**Pump Motor**—Bulletin P-5-A gives engineering specifications for continuous 2000-psi service. (Page 66)
A-10-307	Detroit Broach & Machine Co.	**Broaching Machines**—New bulletin contains data on vertical single ram machine. (Page 307)
A-10-260	The DoAll Co.	**Band Sawing**—Operational data on DoAll contour-matic band machines available in catalog. (Page 260)
A-10-153	Eastman Kodak Co.	**Photography**—"High-Speed Motion Pictures at the Service of the Engineer" available in new booklet. (Page 153)
A-10-203-2	The Gaertner Scientific Corp.	**Microscopes**—Bulletin 161-54 shows applications, models and specifications for toolmakers' use. (Page 203)
A-10-202	Goddard & Goddard Co.	**Milling Cutters**—Catalog F contains listing of standards carried in stock. (Page 202)
A-10-240	Greenlee Bros. & Co.	**Automatics**—Catalog A-405 contains data on Greenlee automatic bar machines. (Page 240)
A-10-239	Hannifin Corp.	**Cylinders**—Hannifin Cylinder File contains data on 5 lines of Hannifin cylinders. (Page 239)
A-10-192	The Hydraulic Press Mfg. Co.	**Hydraulic Systems**—Specifications contained in Bulletin 1101. (Page 192)
A-10-195-2	Ideal Industries, Inc.	**Live Centers**—Booklet contains data on Ideal's line of live centers. (Page 195)
A-10-262	Lincoln Electric Co.	**Welding**—Specifications on new automatic Lincolnweld contained in Bulletin SB-1355. (Page 262)

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Literature Number	COMPANY	DESCRIPTION
A-10-214	Lincoln Gage Co.	**Gages**—Catalog illustrates and describes Lincoln gages. (Page 214)
A-10-266-3	W. F. Meyers Co., Inc.	**Drill Bushings**—Catalog 42 contains information on Meyco carbide inserted drill jig bushings. (Page 266)
A-10-227	Miller Fluid Power Div. Flick-Reedy Corp.	**Pressure Boosters**—Fluid pressure booster specifications contained in Miller Bulletin B-200. (Page 227)
A-10-286	Mohawk Tools, Inc.	**Cutting Tools**—Catalog contains data on Mohawk cutting tools. (Page 286)
A-10-BC	The National Acme Co.	**Automatics**—Bulletin B.S.A.-54 contains data on single-spindle automatics. (Back Cover)
A-10-68	The Ohio Crankshaft Co.	**Induction Hardening**—"Typical Results of TOCCO Induction Hardening and Heat Treating" available in booklet form. (Page 68)
A-10-195-1	O'Neil-Irwin Mfg. Co.	**Box Finger Brake**—Book contains helpful hints on selecting Di-Acro brakes for forming jobs. (Page 195)
A-10-266-1	Pangborn Corp.	**Blast Cleaning**—Bulletin 1402 contains data on hydro-finish wet blasting. (Page 266)
A-10-277	The Pipe Machinery Co.	**Thread Checker**—Pamphlet No. 2 contains data on "drunken thread checker." (Page 277)
A-10-309	R and L Tools	**Toolholders**—New catalog describes the R and L line. (Page 309)
A-10-250	Rivett Lathe & Grinder, Inc.	**Control Valves**—Catalogs No. 204 and 260 contain specifications and drawings on Rivett hydraulic valves. (Page 250)
A-10-38	The Rotor Tool Co.	**Air Tools**—Bulletins No. 45 and 46 contain operational data on Rotor air tools. (Page 38)
A-10-45	Sciaky Bros., Inc.	**Welding Machines**—"Resistance Welding at Work," Vol. 4-‡10 contains operational data on Sciaky resistant welders. (Page 45)
A-10-179	Sheldon Machine Co. Inc.	**Lathes**—Data on Sheldon lathes contained in Catalog G-55. (Page 179)
A-10-37	Simonds Abrasive Co.	**Grinding Wheels**—Bulletin ESA 54 describes surface grinding with Simonds abrasives. (Page 37)
A-10-301	Simonds Saw and Steel Co.	**Shear Knives**—"Shear Selector Chart" helps select knives for various cutting operations. (Page 301)
A-10-151-1	South Bend Lathe	**Lathes**—Bulletin contains data for attachments on turret lathes. (Page 151)
A-10-208	Standard Parts Co.	**Fixture Components**—Catalog describes jig and fixture components. (Page 208)
A-10-59	Standard Pressed Steel Co.	**Socket Head Cap Screws**—Bulletin 2193 contains data on Unbrako self-locking socket cap screws. (Pages 58-59)
A-10-289	The L. S. Starrett Co.	**Dial Indicators**—Catalog No. 27 contains operational data on Starrett dial indicators. (Page 289)
A-10-50	Taft-Peirce Mfg. Co.	**Gages**—Catalog No. 613 contains data on Comp-U-tair air gage. (Page 50)
A-10-154	The Tomkins-Johnson Co.	**Cylinders**—Bulletin SM-155-3 contains engineering specfications on T-J "Spacemaker" cylinders. (Page 154)
A-10-287-2	The Vaill Engineering Co.	**Forming Machines**—Bulletin T-1 describes Vaill tube end-forming machines. (Page 287)
A-10-144	Vascoloy-Ramet Corp.	**Cast Alloy**—Catalog contains charts, tables, recommendations and data on Tantung cast alloy. (Page 144)
A-10-186	Verson Allsteel Press Co.	**Press Brakes**—Catalog B-55 gives designed details and specifications on Verson press brakes. (Page 186)
A-10-176	Wales Strippit Co.	**Die Equipment**—Bulletin No. 12J contains data on the Wales way of punching units. (Page 176)
A-10-276-3	West Point Mfg. Co.	**Hold-down Component**—Bulletin and template sheets available for Swing-lock fixture clamp. (Page 276)
A-10-242-1	S. B. Whistler & Sons, Inc.	**Dies**—Illustrated catalog shows simplicity, economy and versatility of Whistler adjustable dies. (Page 242)
A-10-204	Wiedemann Machine Co.	**Presses**—Bulletin 101 contains data on Wiedemann turret punch presses. (Page 204)

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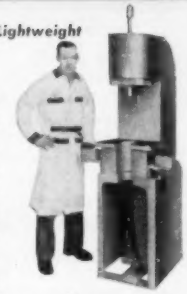

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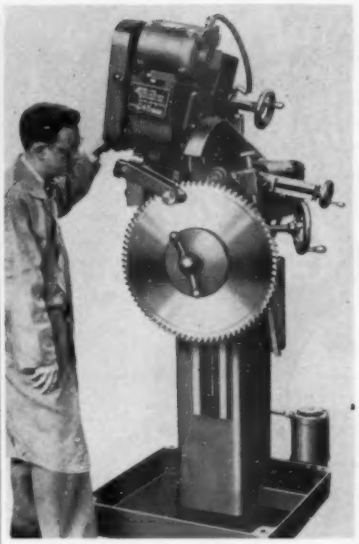


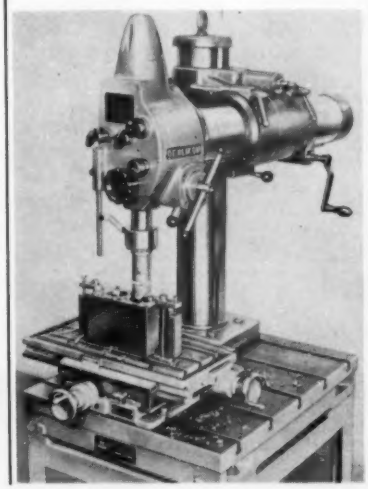
teeth. Grinding contour is automatically produced by cam action with index plates controlling the tooth spacing. Varying diameters, thicknesses, rake angles and pitches can be ground.

The Motch & Merryweather Machinery Co., 1250 E. 222nd St., Cleveland 17, Ohio. **T-10-1691**

All-Angle Borer

Combining a radial swiveling arm with a freely swiveling head, the Oerlikon UB2 all-angle precision borer is capable of performing a wide variety of general workshop operations. The boring head can be canted to any angle or latched accurately into the vertical and horizontal positions.

Range of speeds from 30 to 3070 rpm and 3 power feeds, combined with a compound table for coordinate location, make the UB2 suitable for toolroom



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work. It may be used as a portable radial drill and borer, or for production work in combination with other machines.

The self-contained drilling and boring unit, as well as the precision compound table can also be used independently.

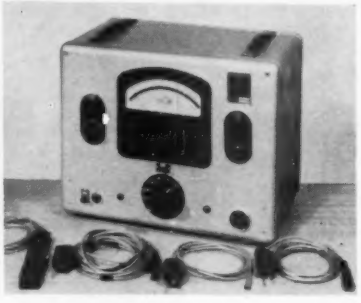
Accessories include: precision chuck, tapping heads, collets holder, adjustable boring head, facing and turning head, trepanning tool, boring bars.

Olkon Research Corp., 630 Fifth Ave., New York 20, N. Y. **T-10-1701**

Magnetic Field Measuring Device

A precision magnetic-field meter, the Magnatest FM-200 is used for measuring static d-c magnetic fields as small as 0.01 millioersted with an accuracy of ± 1 percent of the scale reading. The instrument has ten ranges, from 1 to 1000 millioersteds full scale.

The FM-200 is equipped with several different types of probes which expand



its usefulness to applications including both absolute and differential measurements. When used with a recording instrument the speed of response is on the order of 0.001 seconds.

A second device, Magnatest coercive force meter (FM-300), has similar characteristics.

Magnaflux Corp., 7300 W. Lawrence Ave., Chicago 31, Ill. **T-10-1702**

Dieing Machines

Automatic double crank dieing machines, called the S-2, are designed to produce large-size stampings requiring large bed areas but not necessarily heavy tonnage capacities. At the same time, they provide strength necessary for turning out eccentrically loaded parts by progressive stamping methods.

In the double crank machine, pressure is applied by two crankshaft connections located in the base, providing an even distribution of force over a long bed area. A welded steel frame is

completely enclosed to prevent chips, slugs, stock lubricating compound and other foreign matter from entering and damaging working parts. A self-contained re-circulating lubricating system is a standard feature. A "sandwich" of vibration and noise-absorbing material separates the lower and upper base. The upper crosshead can be equipped with an adjusting motor and brake to provide power adjustment for die setting.

The roll feed incorporates box gearing so that when the roller is raised the stock gearing remains meshed. Peneumatic cylinders, with adjustable air pressure, provide tension on upper rolls.

The standard machine is equipped with a mechanism to give a feed cycle

of 180 deg. Feed pitch is adjustable over entire range while machine is in operation.

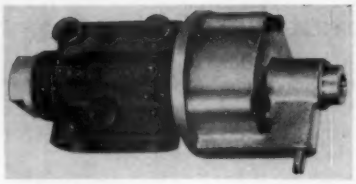
Rated capacity of machine near bottom of stroke is 150 tons; standard stroke is 3 in.; maximum width of material that can be fed is 18 in.; maximum length of feed is 12 in.

Henry & Wright, Div. of Emhart Mfg. Co., Hartford, Conn. **T-10-1711**

Time-Delay Valve

These 2, 3 and 4-way time delay values provide delayed actuation with immediate reversal or immediate actuation and delayed reversal. Working on a volume principle, operating time of from 0 to 5 minutes' delay may be accomplished by manual preset adjustment.

Because they are pilot operated, these valves may be remotely located and



controlled from a central station.

The valves are available in standard pipe sizes ¼, ⅜, ½ and ¾ in.

Airmatic Valves, Inc., 7313 Associate Ave., Cleveland 9, Ohio. **T-10-1712**

Linear Bearings

Ball bearings for linear motion, called adjustable diameter ball bushings, are split longitudinaly and are designed to provide line-to-line or slight preload fits easily when mounted in an adjustable diameter housing.

They permit free-running, no-play linear motion because they enable the tolerances on the shaft diameter and bearing bore to be adjusted out. This principle also provides for compensation for wear that might develop in severe

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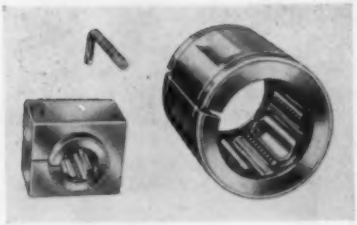


applications.

The bearings frequently are used in a housing that is merely split and provided with an adjusting screw.

Adjustable diameter ball bushings are available in standard sizes for shaft diameters ranging from 1 to 4 in.

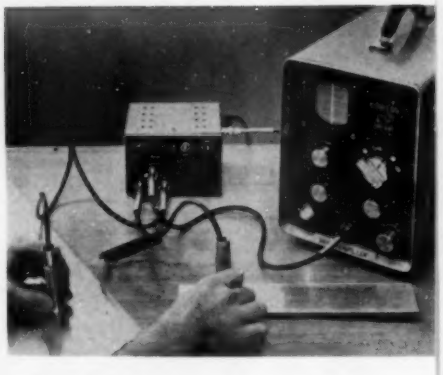
Thomson Industries, Inc., Manhasset, N. Y. **T-10-1721**

Ultrasonic Thickness Gage

The SO-100 Sonizon ultrasonic thickness measuring instrument provides rapid, accurate reading of thickness, in production testing, by means of the visual cathode tube presentation.

Because of its small case, light weight (30 lb), and 5-ft long search cable, it is easily adapted for use in constricted areas. The 3-in. presentation tube has a bright and clear trace; light shields are never needed, even in outdoor work. Accuracy of ±1 percent of thickness is attainable.

Circuits for automatic operation are built into the new SO-100 Sonizon, and may be used to impose predetermined tolerance limits on the instrument so that it will automatically actuate "go not-go" equipment or alarms, depending upon the measurement.



Thicknesses beyond the normal direct reading range (0.500 in.) are easily measured. A special clipper circuit eliminates hash or noise, equalizes the sizes of pips, and narrows the pip base to a straight line, resulting in accurate reading of multiple harmonic pips. A simple harmonic calculator is included with the unit, for making measurements rapidly up to 4 in. without any calculations. With an accessory Sonizon harmonic comparator, the direct reading range of the Sonizon is increased to 5.0 in.

Magnaflux Corp., 7300 W. Lawrence Ave., Chicago 31, Ill. **T-10-1722**

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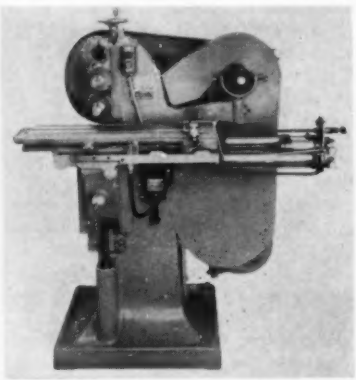
There is a difference in end mills . . . MELIN end mills! Proof of this is evident in the continued increase in MELIN popularity. The growth in MELIN tool acceptance was by no means an accident . . . The secret is in CONSISTENT QUALITY. This standard of Quality assures you better performance . . . longer lasting performance . . . CONTINUOUSLY . . . from one shipment to another. Next time you order end mills . . . specify the finest . . . specify MELIN.
MELIN END MILLS
MANUFACTURED IN TWO, THREE AND FOUR FLUTE TYPES.
Representatives in principal cities.
MELIN TOOL COMPANY, INC.
3372 West 140th Street
Cleveland 11, Ohio
MELIN TOOL CO. INC.

USE READER SERVICE CARD ON PAGE 167 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Feed for Hand Mill

A 12-in. stroke skip table feed, developed for use on U.S. hand mills, combines with a new two-spindle head to double the production capacity of the mills. Two or more workpieces can be milled during each complete pass.

The two-spindle head can also be adapted to the company's hand or power table feed millers. The lower spindle is mounted in a fixed position. The upper



FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-172

spindle may be raised or lowered to handle various sizes and types of workpieces, and to compensate for cutter wear.

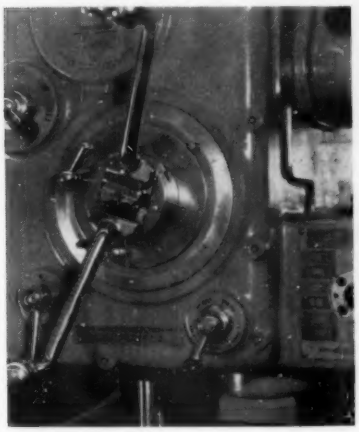
The lower spindle is driven by V-belt from the backshaft pulley. The upper spindle is driven through a gear train from the lower spindle. The spindles rotate in opposite directions to permit conventional milling from both positions.

U. S. Burke Machine Tool Div., Cincinnati Mfg. Corp., Cincinnati 27, Ohio. **T-10-1731**

Radial Drill Boring Attachment

Users of deluxe models of 9 and 11 in. column Hole Wizard radial drills are offered a fine-feed boring attachment designed to supply six feeds from 0.001 to 0.00625 in. per revolution of the spindle.

The change from the standard-feed range to the fine-feed range, or vice



versa, is made through a conveniently located lever at the lower right-hand side of the head.

The American Tool Works Co., Pearl St. at Eggleston Ave., Cincinnati 2, Ohio. **T-10-1732**

Fire Resistant Hydraulic Fluid

An economical snuffer type hydraulic fluid, called Irus Fluid 902 will not burn on contact with flames, heated metal surface or molten metal. A special formulation of water, petroleum hydraulic oil and emulsifying agents, it is particularly suitable in locations where hydraulic leaks or line ruptures would be immediate fire or explosion hazards.

It releases its water content as a protective steam blanket to quench fire, reducing local temperatures and

an engineer wants to know

MEMO:

TO: Purchasing
FROM: Production Engineering

Tom—
With a little outside help, I think we could ream and bore those castings in one operation—with gun drills.
Would you get a Chicago—Latrobe engineer in for consultation? I hear they are best in that field. E.T.

Much is new with gun drills. They are being used today on a variety of applications unheard of a short while ago. So much has happened—so fast—that it has been difficult for many of the most expert technicians to keep fully informed. A good place to get sound advice on the use of gun drills in any plant is from a Chicago-Latrobe service-engineer. They are pioneers both in production of finer tools and in development of techniques for their use. Call C-L soon . . . without obligation, of course.

Chicago-Latrobe

CARBIDE TIPPED GUN DRILLS

DOUBLE CIRCLE TOOLS

Part of the Chicago-Latrobe COMPLETE line . . . available through service-minded Industrial Distributors.

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434 W. ONTARIO ST., CHICAGO 10, ILLINOIS
DRILLS • REAMERS • COUNTERSINKS • COUNTERBORES • SPECIAL TOOLS

Ask for Circular 200

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-173

displacing oxygen from the immediate area. Ordinarily the remainder of the hydraulic fluid will not support its own combustion. Oil in the solution will continue hydraulic action should the water be dissipated for any reason. The fluid is noncorrosive on ferrous and most nonferrous metals, and is compatible with normal system components.

Irus Fluid 902 can replace any conventional mineral or synthetic oil hydraulic system, and can be installed without modification of lines, pumps, valves or cylinders. Preparation of existing systems prior to installation of the fluid requires only thorough cleaning to remove previous materials.

Shell Oil Co., 50 W. 50th St., New York 22, N. Y. **T-10-1741**

Torque Wrench Tester

Torque wrench calibration has been simplified with this tester which measures torque electrically by means of special SR-4 resistance-wire strain-gage type torque transducers.

Sturdy in construction, the tester maintains accuracy through a wide temperature range, is easy to use, and covers a wide range of torque-testing capacity. There are no moving parts, knife edges, mechanical linkages, or friction devices. Torque is sensed by small interchangeable torque pickups on which SR-4 strain gages are bonded. Torque can be read in inch-pounds: 1 in-lb per division up to 2040 in-lb, and 5 in-lb per division up to 6200 in-lb.

Operating controls include a loading knob, range selector switch, and load step switch to utilize a 440-division indicator scale on different sections of the full scales to 2040 and 6200 in-lb. The tester itself can be calibrated readily by means of a calibration arm and dead weights.

The tester is 40 in. long, 24 in. deep and 18 in. high over-all. Total weight is 300 lb.

Electronics & Instrumentation Div., Baldwin-Lima-Hamilton Corp., 806 Massachusetts Ave., Cambridge 39, Mass. **T-10-1742**

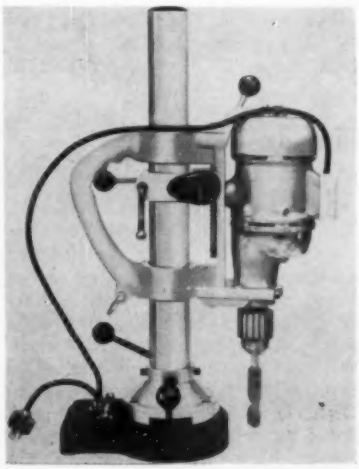
Drill Press with Magnetic Base

Mag-Tool drill press incorporates an electromagnetic base which attaches magnetically to ferrous surfaces for on-the-spot drilling, tapping, reaming and other drill-press operations. The tool operates in any position to drill holes up to 2 in. in diameter. The unit weighs 45 lb.

Micrometer adjustment enables movement of the drill bit for precise positioning after the magnetic base has been locked in place.

Mag-Tool requires only one operator, and no special skill is necessary.

Magnetic Tool Corp., 1955 Lafayette St., Santa Clara, Calif. **T-10-1743**



HEAVY-DUTY AIR (or Oil) CLAMPS

Never send a boy TO DO A MAN'S JOB

Design with clamps rated to the job they must do. Knu-vise heavy-duty clamps possess the extra margin of life needed because they're rugged, strong, built to stand abuse.

Knu-vise heavy-duty clamps are air (or oil) and hand operated—have either solid or channel bars. Featured are:

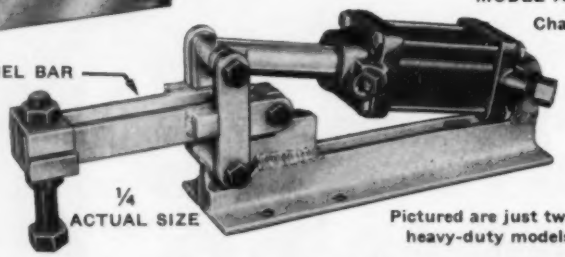
1. Hardened and ground bearing bolts
2. Self-locking nuts for minute adjustment of parts
3. Toggle bars from C.R.S. bars
4. Easy and complete replaceability of parts

SOLID BAR

MODEL AOS-400 (HD)—Solid Bar

MODEL AO-400 (HD) Channel Bar

CHANNEL BAR



¼ ACTUAL SIZE

Pictured are just two of several heavy-duty models available.

In a high production automobile plant, a Lapeer installation lasted for more than 1,300,000 cycles. After a small repair, the installation has passed the 2,000,000 mark and is still going strong. Better write today for complete information. No obligation, of course.

Manufacturers of over 150 models of manually and air-operated clamps and pliers

KNU-VISE PRODUCTS — LAPEER MANUFACTURING CO.

3053 DAVISON ROAD • LAPEER, MICHIGAN

WESTERN DIVISION: 422 Magnolia, Glendale, California • CANADIAN DIVISION: Higginson Engr., Hamilton, Ontario

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-174

Automatic Gear Checker

Red Ring Model GRD automatic gear gaging, sorting and machine tool control unit has a compact basic design that features standardized components which can be adapted to the checking of individual spur or helical gears up to 3 in. in diam and 3 in. wide. It is available in types that will check and sort production gears for both size and helix angle accuracy, or size or helix angle only. It will shut down gear production machine tools automatically after a specified amount of rejects of a specific

type is gaged. Indicator lights tell the type of reject that caused the machine shutdown.

Complete machine consists of a motorized gaging and sorting unit, through which the gears are fed one at a time automatically from an inclined feed chute, a stand that supports the gaging unit and reject pans, a separate electrical panel and an individual push-button and indicator light control box. The panel and control box can be mounted either near the machine or at a remote location according to the requirements of the user.

National Broach and Machine Co., 5600 St. Jean Ave., Detroit 13, Mich.

T-10-1751

Radial Drill

Boring and reaming, as well as drilling, may be done on this 3-ft, 12-in. radial drill, often without the use of pilots.

In place of the conventional type arm that moves up and down the column, the unit has a fixed arm which remains at the same height and can be swung 360 deg. To position the workpiece, a motorized table moves vertically on the column, placing the workpiece at the appropriate height for the job.

The table, also capable of swinging

WENDT-SONIS

*NO-CHAT shanks increase tool life

for

BORING BARS

GRINDING QUILLS

TOOL SHANKS

"No-Chat" is an ideal body material for boring bars. Very dense and rigid, "No-Chat" reduces vibration and chatter and eliminates taper in deep hole boring. Heavier cuts can be taken and hole finish is improved. Straight, accurate holes are possible even with excessive tool overhang.

"No-Chat" grinding quills give better finishes to closer tolerances.

Cut-off tools of "No-Chat" can be made narrower to reduce waste. Higher strength permits greater feeds and deeper cuts by minimizing deflection and reducing chatter.

"No-Chat" is available in round, square or rectangular stock or as finished tools with brazed or mechanically held tips.

For more information ask your local Wendt-Sonis distributor or fill in the attached coupon.

WENDT-SONIS
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*"No-Chat" is a registered trade name of the P. R. Mallory Co.

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Dept. TEN-1056, HANNIBAL, MISSOURI

Please send me literature on Wendt-Sonis "No-Chat."

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WALES CD UNITS
. . . increased our HOLE PUNCHING PROFITS

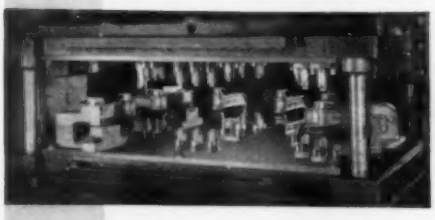
For punching round or shaped holes up to 2" dia. in ⅛" mild steel.

Other WALES units available for punching holes up to 3½" dia. in stock up to ¾" thick.

● You can always *save* TIME and MONEY with WALES CD Units. ELIMINATE stripper plates, custom punches and dies.

CD Units are mounted in sets — outside the press. Change set-ups in 'jig time'. All parts are interchangeable. Maintenance costs are pared to the bone. Alignment is automatic and accurate.

Press down-time is practically non-existent. For multiple hole punching, nothing equals the speed and simplicity of WALES CD punch and die assemblies.



Showing WALES CD Units in same set-up with WALES BL Hole Punching Units and WALES Type N Notching Units in punch press.

Send for BULLETIN No. 12J

The CD story is factual and sure to suggest many ways to enable your hole punching shop to make more money. Sent free.

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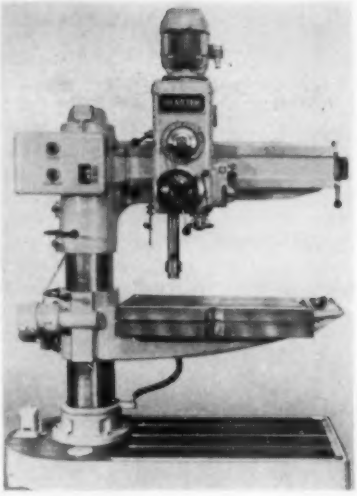


360 deg, can be moved out of the way when the base is to be used for fixturing large workpieces. Both the arm and the table have locking devices.

Both a handwheel and fine handwheel are available for advancing the spindle. Strong, one-piece 12-in. column contributes to precise operation.

A mechanical preselector provides 12 spindle speeds, ranging from 60 to 2100 rpm, with reverse speeds. A feed-and-speed calculator offers selection of 4 spindle feeds. A graduated depth control dial for use during hand or power operation prevents overdrilling.

Tapping can be done quickly simply by proper shifting of the forward and reverse clutch lever.

All controls are centrally located on the head and arm support.

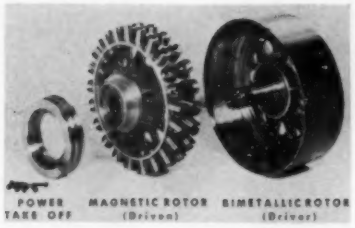
S & S Machinery Co., 140 53rd St., Brooklyn, N. Y. **T-10-1761**

USE READER SERVICE CARD ON PAGE 167 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Magnetic Drives

The Whitney-Tormag magnetic drive provides a flexible slip type drive between a motor and its load, in a range from fractional to over 50 hp. Cylindrical design of the drive is adaptable to the new NEMA frame specifications, permitting the drive unit to be smaller in diameter than an electric motor of similar horsepower. It consists of a magnetic rotor and a bimetallic rotor, mounted face to face with an air space between them.

The unit provides shockless, vibration-free drive, without mechanical or fluid coupling. It can handle heavy, unbalanced or fluctuating loads. It provides 95 percent efficiency at rated horsepower. The unit remains un-



affected by exterior temperatures from 250 to −60 F. It is fully reversible, and can be used as a dynamic brake. Motors are powered to actual running requirements. No oversize provision or special winding is necessary for starting or stalling demands.

Overload protection is provided for the driving motor. It can be run in full stall indefinitely without harming the motor or the magnetic drive.

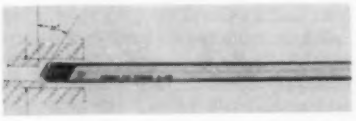
Whitney Chain Co., Hartford, Conn.

T-10-1771

Lathe Boring Bars

These boring bars are designed for through hole boring and boring to a shoulder. Tool bits are positioned in the bars at 30 deg from the shoulder being bored, permitting the tool bit to cut ahead of the boring bar. Bars are manufactured in diameters of ⅜ to 1½ in.

Tool bits are clamped mechanically to allow use of either HSS or solid carbide bits in the same bar. Large-area



clamping distributes the clamping pressure over a wide bit area; positive seating of bit is assured because it is firmly wedged into "V" groove of the bar, preventing any tendency of the bit to move sideways while in cut. This design also assures accurate positions when replacing tool kit. Built-in positive side rake is constant throughout entire length of bit.

Everede Tool Co., Dept. 146, 2000 N. Parkside Ave., Chicago 39, Ill.

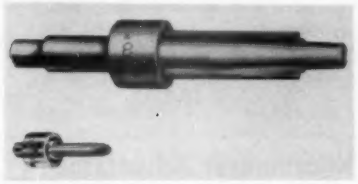
T-10-1772

Expanding Mandrel

Count-Centric expanding mandrels have straight jaws, which provide long bearing surface over a wide bore range. This feature permits a large bore expansion without change of jaws or sleeve.

Permanent jaws maintain built-in precision to 0.0005 in. tir for type "B" and to 0.0002 in. tir with type "SB." They also permit heavy cuts without chattering. A set of 14 tools provides for every bore size from ⅜ to 3¼ in.

A miniature duplicate of the Count-Centric straight-jaw mandrels is the



type "M" and "SM" Micro-Mite expanding mandrel. Six standard tools provide every arbor from ¼ to ⅜ in.

The Le Count Tool Works, Inc., 390 Capitol Ave., Hartford, Conn. T-10-48

Internal Contouring Slide Tool

Hydraulic-controlled internal contouring slide tool attachment is designed for fast, accurate internal contour boring of complex shapes, as well as large diameter contour turning. Low setup time enables both small and large-lot production to be handled economically.

Engineered for application to 3-A and 4-A extra heavy-duty saddle type turret lathes, the new contouring slide tool mounts, at a 60-deg angle to the spindle center line, on any one face of the hexagon turret of those lathes. The complete tool, with template holder and template attached, indexes with the turret to avoid interference with other tooling.

Long piston stroke of the cylinder which actuates the attachment's tracer

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helps
Machine Builders
back their
Production Claims
Capacity 51,840 Blanks per hour
WATERBURY FARREL
You can design a masterly machine for either automation or regular production. But you cannot guarantee that it will operate to full capacity unless its metal-cutting components are wholly reliable. Circle R saws and other circular metal-cutting tools are the best you can buy, yet cost no more. Performance records prove that they ensure longer runs, less down time, consistent precision. We are prepared to advise you on selection of Circle R tools to bring out the full capabilities of your products. Ask for Catalog N.
We advise on special requirements for automation
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COMBINED DRILLS & COUNTERSINKS • CENTER REAMERS
CIRCULAR TOOL CO., INC.
PROVIDENCE 5, RHODE ISLAND
Specialists in Circular Cutting Tools Since 1923

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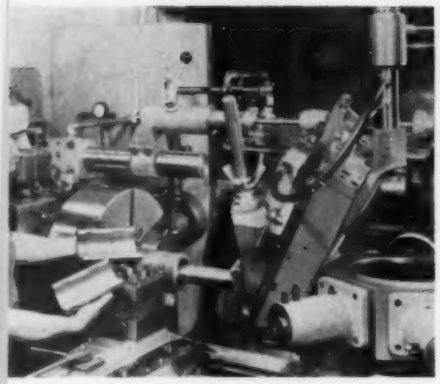


slide provides an effective cutter travel of 4 in.

Following machining, clearing of the cutting tool is accomplished manually by a flip of the cylinder return lever. A special adjustable safety stop block prevents accidental contact between the tool and opposite side of the work.

The micrometer-adjusted tool-holding block used with the contouring slide tool provides precision adjustments over a vertical range of 10¼ in.

Tracing action of the contour slide tool can be controlled in two directions by the addition of a special dual template. Thus, with a special 2-cutter bar mounted in the toolholder, an optional setup can be provided which will allow the attachment to contour bore both in and out.

Regular turret lathe work may be performed at any time on machines equipped with the contouring slide tool attachment.

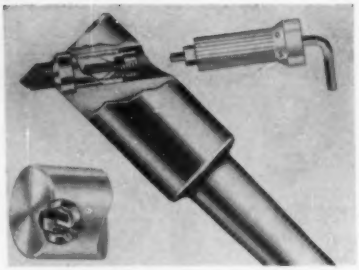
The Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 13, Ohio. **T-10-1781**

Micrometer Adjustable Cutting Tool

This single-point tool cartridge can be installed in a boring bar by simply drilling and finishing two holes. The tool, called Acra-Bore, provides micrometer adjustment and positive positioning, and rigid clamping with no backlash in either direction for precisely and easily projecting and retracting the tool bit.

The cartridge may be applied to boring bars or other tools and may be used singly or in clusters to close limits.

The assembled unit is composed of a round tool bit, a threaded cartridge sleeve, a conical-shaped adjusting screw and a socket head lock screw. Engagement of the adjusting screw and the tool bit assures rigid support in the toolholder.



Adjustment of the bit is controlled by means of a graduated adjusting wrench. A single mark or graduation is all that is needed on the bar or tool proper.

Three sizes of cartridges are available. Tool bit sizes are ¼, ⅜, and ½ in. For each of the three sizes, a unit is provided that is mounted 90 deg to the axis of rotation and one that is mounted 53 deg to the tool axis. The same graduated adjusting wrench is used for both mountings.

The Gairing Tool Co., 21221 Hoover Rd., Detroit 32, Mich. **T-10-1782**

Ceramic Linings for Heavy-Duty Clutches

Clutch plates for a line of heavy-duty clutches employ ceramic linings in place of conventional organic facings. These new linings are highly resistant to heat and frictional wear.

Ceramic friction material is compressed within shallow metal cups or buttons, with 6 such buttons comprising the facing on each side of the plate for clutches up to 14 in., and 12 on each side for clutches 14 in. and over.

Linings provide a load capacity up to 50 percent greater than that of the conventional facing.

Generated heat is dissipated quickly, since air is permitted to circulate through the spaces around the individual retaining cups.

Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y. **T-10-1783**

sound engineering

lies behind every automation program. Pioneer has a quarter-century of experience with both. No obligation if you'd like to know more.

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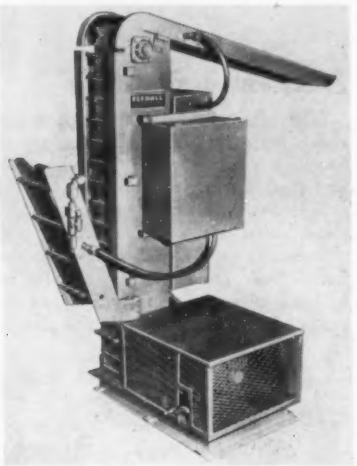
Elevating Transfer Conveyor

Special Model 4000 elevating conveyor is designed to transfer long cylindrical parts from one production machine to another. It accepts parts in a rolling position from discharge chute of the first machine, elevates them and delivers them to the magazine of the next production machine. The conveyor operates at delivery rate adjusted to that of the second production machine and is equipped with a



bank control which shuts off the first machine if it is feeding faster than the second machine can handle parts.

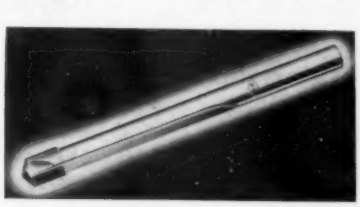
The unit will handle cylindrical parts from ⅜ to 1¼ in. in diameter and up to 12 in. long. Power is furnished by a ¼-hp, 220/440-v motor through an adjustable-speed drive.

Feedall, Inc., Willoughby, Ohio. **T-10-1791**

USE READER SERVICE CARD ON PAGE 167 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Carbide Drills

Line of carbide drills is designed specifically for drilling hardened die steel. With these drills hardened parts may be economically salvaged without annealing, reworking and rehardening. They also can be used for cutting through hard outer cases and for drilling intricate parts. Such drilling operations are carried out after hardening, because of possible heat distortion.

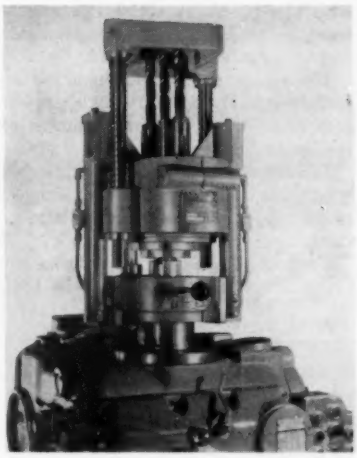


The carbide die drills are available in sizes 1/16 to ¾ in. and in sets.

Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich. **T-10-1792**

Air Counterbalance Swivel Attachment

A combination swivel and air counterbalance attachment has made it possible to adapt large multiple-spindle drill and tapping heads for use on radial drilling machines. It provides built-in safety, both for the feed mechanism of the machine and for the operator. It also provides operating efficiency, flexibility and



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BUILT
• • • to Turn out PROFITS

Sheldon Lathes are designed and built to do accurate lathe work rapidly and profitably. Moderate in price they have the collet, swing and power capacity to do most toolroom work.

UM56P
13" Swing Lathe
34" Between Centers
Rapid Shifting "U" Drive

UM56P
$1615.00
Base Price
F.O.B.
Chicago

Design Features:
- Large and wide "Zero Precision" Tapered Roller Spindle Bearings—permit operation at all speeds, retain accuracy, and expensive bearing maintenance costs.
- 54-pitch Gear Box—gives both standard and many hard to get thread ratios.
- Large Micrometer Dials—Make accurate operation easier.
- Extra Collet Capacity—1⅜" hole through spindles available on 10", 11" and 13" swing lathes.
- More Power to Spindle—Efficient drives with bigger motors and double neoprene cog V-belts to spindle.

OPTIONAL FEATURES AT EXTRA COST
include: Hardened ways, Long Tapered Key Drive Spindles, 4" D1 Camlock Spindles bed turrets, collet attachments, and other production and toolroom accessories. Lathes available with a choice of "Bench," "Cabinet" or "Pedestal" mountings.

Write for New Catalog G-55

SHELDON MACHINE CO., Inc.
4229 N. Knox Ave. • Chicago 41, Illinois

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-179

ease of adjustment. With this attachment, an air filter, a pressure regulator and an air oiler are furnished.

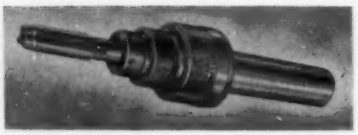
The special radial drill mounting attachment incorporates a 360-deg swivel feature to enable proper alignment of the entire drill head.

The fixed center and the adjustable type heads operate equally well with the swivel and air counterbalance attachment.

U. S. Drill Head Co., 616 Burns St., Cincinnati, Ohio. **T-10-1801**

Floating Holder

Roller type floating toolholder, engineered for quick, easy tool changes without the use of wrenches, is designed for extra bearing capacity to withstand heavy thrust loads. An internal adjusting screw permits presetting the cutting tool. A snap-ring mounted, interchangeable collet is designed so there is no need for presetting entire holders and also serves to reduce the number of holders needed.



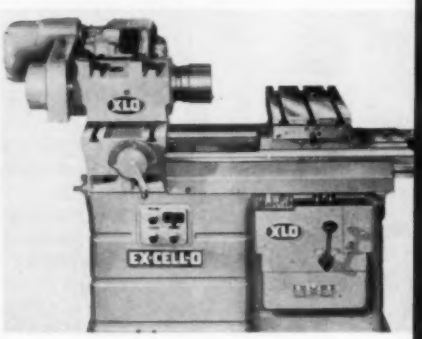
Two types of interchangeable collets of similar design are provided—one for taps and one for reamers. Both feature a trepan tool clamping principle which is accurately machined to assure close concentricity. The floating holders are available in all shank types and in a range of sizes.

Seibert and Sons, Inc., Cheona, Ill. **T-10-1802**

Precision Boring Unit

High-production precision boring machine, Style 2112-B, can be arranged to handle a wide variety of toolroom work and short production runs.

Selective-cycle equipment, adjustable-speed drive, and universal fixture provide flexibility. Horizontal slide of the fixture may be operated manually or hydraulically. A vertical slide can be mounted parallel or at right angles to



the spindle. Change-overs from one job to another are quickly and easily accomplished.

The machine is particularly suited to boring, turning, grooving, chamfering and facing of medium-size and small parts. With parts mounted on the cross slide, the tools are carried by rotating spindles. Small parts can be rotated on the spindles while the tools are statically supported on the cross slide.

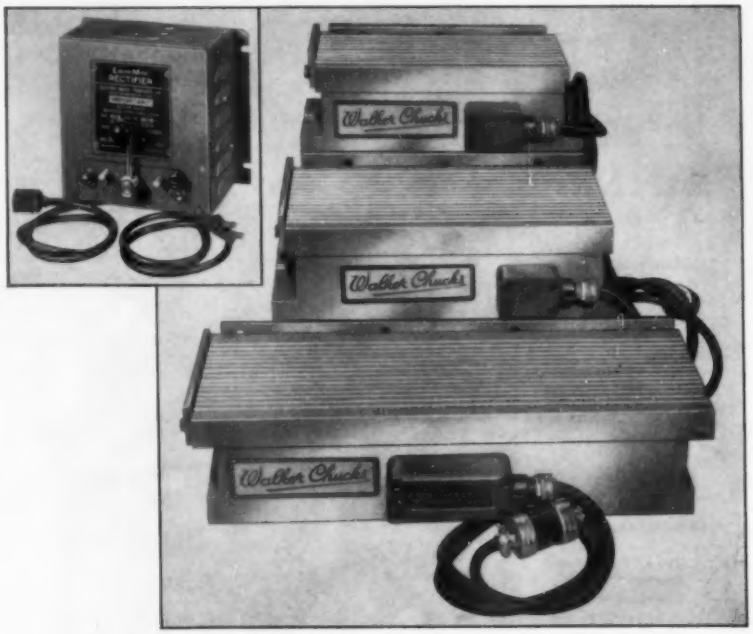
The unit has maximum table travel of 12 in. and table feeds of ½ to 130 ipm, and rapid traverse of 38 fpm.

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich. **T-10-1803**

Automatic Stud Driver

Model SD10-2 automatic stud driver is easily adaptable to from one to three heads. Heads can be changed to a new pattern quickly, using new spacer bars,

Walker Chucks
You May As Well Have the Best



Walker Longitudinal Bar Pole Chucks . . . three popular sizes . . . low wattage, low price, maximum holding.

5" x 10"	$ 78.00
6" x 12"	$110.00
6" x 18"	$185.00

KD Rectifier with built-in switch to operate from any AC line $43.00

O. S. WALKER CO. Inc.
WORCESTER 6, MASSACHUSETTS
Original Designers and Builders of Magnetic Chucks

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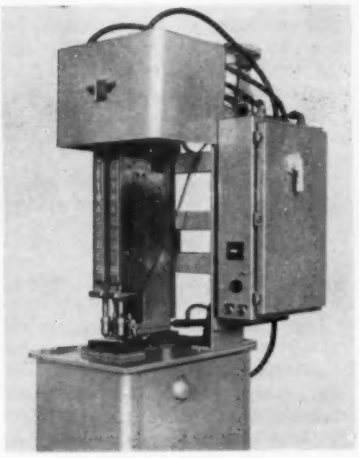

and can be spaced as closely as 2½ in. center to center.

Heads are individually driven by ½-hp motors, a-c, d-c, or air torque, and are fitted with air-draulic or hydraulic connections. Units are equipped with JIC unit type electrical cabinet, vibratory 4-track stud hopper, and either air-draulic or self-contained electric-hydraulic unit. Self-opening chucks, which are positive in drive, grip and release the studs without screwing out the driven studs.

Syracuse Special Machine Co., Inc., 2900 East Erie Boulevard, Syracuse 3, N. Y. **T-10-1811**

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Adjustable Spacing Collars

Accurate spacing of multiple setups on milling machines and other equipment may be accomplished with micrometer adjustable spacing collars. After original setup is made and the trial cut is measured, the correct plus or minus adjustment is made easily. Collars are calibrated in thousandths of an inch, but an adjustment of a quarter-thousandth can be made easily by visual calibration. Adjustments are quick and positive.

Dayton Rogers Mfg. Co., Minneapolis 7, Minn. **T-10-1812**

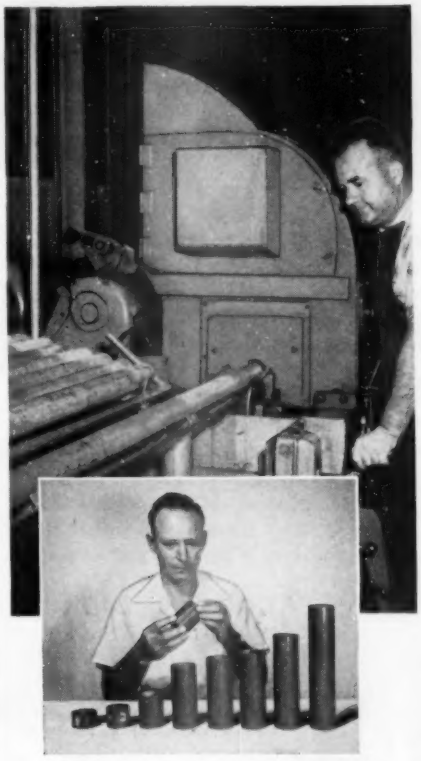
Welding Flux

A dry type welding flux, called Colmonoy flux 6-20, may be used when applying Colmonoy nickel and cobalt-base hard-facing alloys to hard-to-weld metals.

The material, which contains no

Abrasive Cutting | *the best way to cut many materials*
the only way to cut some

Campbell Cut-Off Machines



Cutting 20-foot tubes of stainless steel into 1″ to 17″ lengths

Slice $32,000 a year from tube cutting costs

• Because CAMPBELL Abrasive Cut-Off Machines not only cut stainless steel tubes twice as fast as former methods—but the clean cut saves a deburring process—Ryan Aeronautical Company saved $32,000 the first year of its operation.

Ryan uses thousands of pieces of this stainless steel tubing each month in ball-and-socket joints, nipples and sleeves of exhaust systems. They must be precision-cut from 20-foot pipe in lengths from 1 to 17 inches.

The smooth-finish cut of the CAMPBELL Oscillating Wet Abrasive Cut-Off Machine is extremely accurate—with no hard spots, no change in metallurgical characteristics. It results from the WET cut with abundant coolant supplied just where it will do the most good. Speed and economy come from the OSCILLATION of the abrasive wheel . . . the right one for the job.

Some additional performance figures

Smooth cutting on CAMPBELL Oscillating Wet Abrasive Cut-Off Machine saves an extra grinding operation on gear tooth samples cut for metallurgical study.

International Nickel's tough K Monel, 4¼″ dia., is cut in 2 minutes per cut on a CAMPBELL Oscillating Wet Abrasive Cut-Off Machine.

How to get expert advice on your cutting problems

• CAMPBELL Engineering Service costs you nothing—can save you much. Does your metal cutting problem involve cutting of alloy or high carbon steel? Our Field Engineers are abrasive cutting specialists. They can help you arrive at just the right combination of a CAMPBELL Cut-Off Machine and ALLISON Cutting Wheel that will improve your operation and save you money.

Visit Booth 1816
National Metal Show
Cleveland Auditorium
Oct. 6-12, 1956

ACCO

Campbell Machine Division
AMERICAN CHAIN & CABLE

945 Connecticut Avenue, Bridgeport 2, Connecticut

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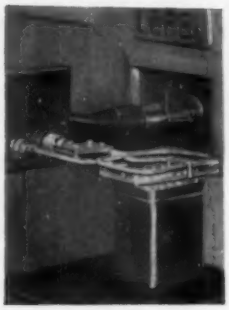
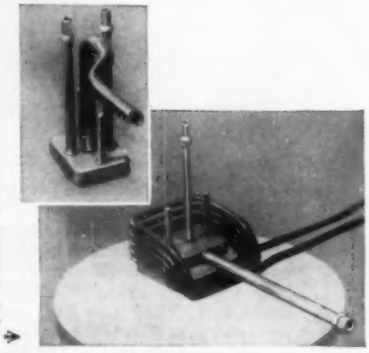
The Lepel line of induction heating units represents the most advanced thought in the field of electronics as well as the most practical and efficient source of heat yet developed for industrial heating. With a background of half a century of electrical and metallurgical experience, the name Lepel has become the symbol for quality in induction heating equipment embodying the highest standards of engineering achievement, dependable low cost operation and safety.

If you are interested in the application of induction heating you are invited to send samples of the work with specifications of the operations to be performed. Our engineers will process these samples and return the completed job with full data and recommendations without any cost or obligation.

TYPICAL INDUCTION HEATING APPLICATIONS



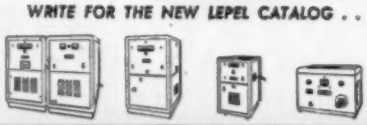
A Lepel installation at Federal Telephone and Radio Co. shown soldering transformer terminals. A precision operation made so simple that even unskilled operators can achieve excellent results on a production basis.



The simultaneous soldering of a group of components within one load coil is an ideal application for induction heating. The assemblies consist of mounting studs and tubes inserted into a machined part together with preformed solder rings. The heating is done so rapidly that there is practically no scaling or discoloration.

Electronic Tube Generators—1 KW; 2½KW; 5 KW; 10 KW; 20 KW; 30 KW; 50 KW; 75 KW; 100 KW.
Spark Gap Converters 2 KW; 4 KW; 7½ KW; 15 KW; 30 KW.

WRITE FOR THE NEW LEPEL CATALOG . . . 36 illustrated pages packed with valuable information.



All Lepel equipment is certified to comply with the requirements of the Federal Communications Commission.

LEPEL HIGH FREQUENCY LABORATORIES, INC.
55th STREET and 37th AVENUE, WOODSIDE 77, NEW YORK CITY, N. Y.

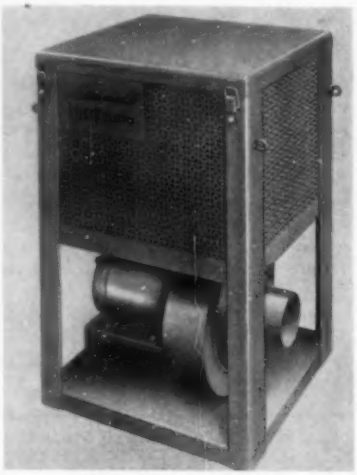
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-182

glare-producing salts, imparts good flow characteristics to hard-facing alloys. Developed particularly for use in hard-facing iron and nickel-base alloys containing chromium, titanium and/or aluminum, it is also suitable for use on cast-iron parts.

Wall Colmonoy Corp., 19345 John R St., Detroit 3, Mich. **T-10-1821**

Mist Collector Unit

Fog, smog and mist from surface, cylindrical and thread grinders, lathes, screw machines and other machine tools using cutting oils are captured by the compact MistKolector. It is available in two models, with volume ranging from



525 to 2685 cfm, and in four motor sizes ranging from ½ to 5 hp.

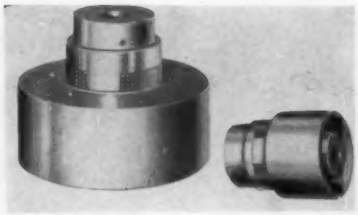
Because of its compact design, it can be mounted on the floor or suspended from the ceiling. Filter needs replacing only when suction loss is noted at the hood or vapor is discharging through the filter.

Hammond Machinery Builders, Inc., 1661 Douglas Ave., Kalamazoo, Mich. **T-10-1822**

Space-Saving Coupling

A brake-drum flange is incorporated on the outer diameter of this coupling, providing a compact drive arrangement. It is particularly useful where shaft length or distance between two units is at a premium. In effect, the brake drum requires no additional space.

The brake-drum coupling is available in eight standard sizes, with horsepower ratings from 2 to 40 at 1750 rpm. Maximum bores of the hub body range from 1 to 2½ in. Drum body bores are made



to motor shaft size specifications. Distance between shafts can be from ½ to 1⅝ in. Cushions are one-piece spider type.

Lovejoy Flexible Coupling Co., Dept. TED, 4801 W. Lake St., Chicago 44, Ill. **T-10-1831**

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Centrifugal Clutch

Small, compact Power Taper centrifugal clutch is designed for motors requiring high torque starting. It also provides accurately predetermined engaging speeds. The clutch is self-energizing in two ways. As the shoe moves out with centrifugal force, a power taper

pin forces the shoe tighter against the drum through lever action.

There is no rigid anchor of the shoes, and they may float 4 deg in any direction, permitting automatic adjustment for any misalignment in shafts when clutch is used as a coupling.

E-Z Machine and Tool Works, Beloit, Wis. **T-10-1832**

Leaded Steel

A leaded-steel engineering material, called Hi-Qua-Led steel has good machining characteristics. Compared with carbon steel, savings in time ranging from 47 to 71 percent have been obtained during lathe operations; time in teeth cutting, lowered as much as 50 percent; tool wear decreased from 46 to 94 percent.

Physical properties of the steel remain basically unchanged, and the pattern of lead distribution is unaffected by the grade of steel.

The material takes good finish, and in some instances it can be acceptable finished with a roughing tool.

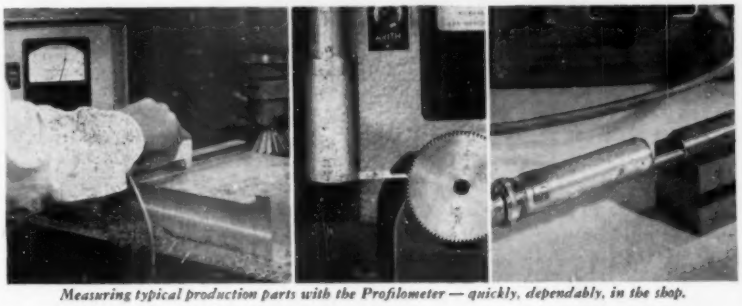
Hi-Qua-Led steel is produced in all steel grades in forged and rolled rings from 18 to 145 in. over-all diameter, and in ingots to 50,000 lb.

Alco Products, Inc., Box 1065, Schenectady, N. Y. **T-10-1833**

Automatic Loader for Gears

Automatic loading device for handling spur or helical internal gears on shaving machines is designed so that it meshes teeth in an internal gear with those of the helical shaving cutter. It utilizes an intermediate air-powered loading sleeve mechanism which receives the internal gears one at a time from a magazine feed, and hangs them on the cutter. The loader illustrated is installed on Red Ring Model GCR in-

Eliminate Production Operations!



Measuring typical production parts with the Profilometer — quickly, dependably, in the shop.

By checking the microinch roughness of production parts with the PROFILOMETER®, you can *eliminate* costly production operations, as follows:

1 **By avoiding over-finishing.** Parts are often made smoother than specified, "to be on the safe side" — at considerable extra cost. By using the Profilometer — *at the machines,* if desired — you can *detect* and *eliminate* such over-finishing.

2 **By detecting other unnecessary operations.** A Profilometer "job analysis" often shows that one or more intermediate grinding or lapping operations can be OMITTED without affecting the quality of the finished parts — and, of course, with substantial savings.

FREE 8-PAGE BULLETIN describes these and other cost-saving applications. Also describes the practical operating features of the Profilometer — first in surface roughness measurement, since 1936. *Write for BULLETIN LT14.*

Profilometer is a registered trade-mark.

MMC MICROMETRICAL MANUFACTURING COMPANY

349 S. MAIN ST. ANN ARBOR, MICHIGAN

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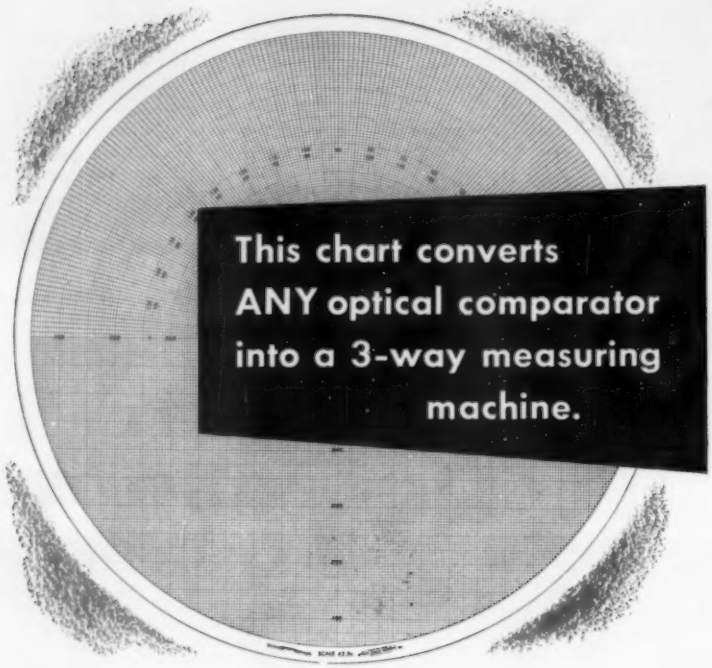

O.G.P. TOOL ROOM CHART-GAGE with grids for vertical horizontal measurements, protractor scale for angles, radius circles for measuring holes, fillets, etc.

Here's why you can save time and money by converting your optical comparator into a measuring machine: The O.G.P. Tool Room Chart simplifies the measurement of tools, dies, gages and parts. For your "run-of-the-mill" measuring jobs, you'll find this much faster than micrometers or gage blocks.

EVERYTHING TO MAKE YOUR OPTICAL COMPARATORS MORE USEFUL

We also supply all types of standard charts, custom charts, layout accessories, fixture bases, and custom fixtures to meet your specialized requirements.

USE THIS COUPON TO GET HELPFUL INFORMATION

OPTICAL GAGING PRODUCTS, INC.
26 Forbes Street, Rochester, New York
I'd like more data on how to use measuring charts to save time and money.
Name..... Title.....
Firm.....
Street and Number.....
City..... State.....

OPTICAL GAGING PRODUCTS, INC.
SPECIALISTS IN PROJECTION GAGING

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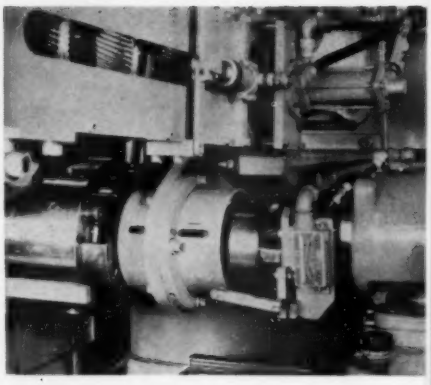


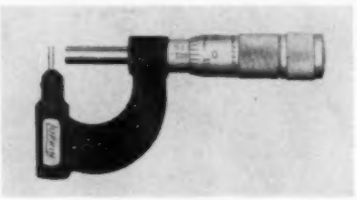
ternal shaving machines. It handles 75-tooth, 20-pitch, 4-in. pitch diam, 20-deg pressure angle, 18½-deg helix angle internal gears at a rate of 70 gears per hour.

Internal gears to be shaved are loaded in a magazine and, after the shaving cycle, are deposited in an unloading magazine at the front of the machine.

National Broach & Machine Co., 5600 St. Jean, Detroit 13, Mich. **T-10-1841**

Outside Micrometer

This hole locating and tubing micrometer has an anvil diameter of 0.089 in.—small enough to enter a 3/32-in. ID hole or slot. The anvil is held with



a setscrew and can be easily and quickly replaced in case of wear or breakage.

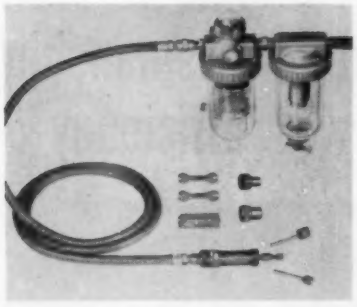
It has a range of 0 to 1 in. by thousandths, and is furnished with either a plain thimble or with a ratchet cap.

The Lufkin Rule Co., Saginaw, Mich. **T-10-1842**

Miniature Grinder

This high-speed, vane type grinder for precision, detailed grinding in toolrooms and on production work is only 3¾ in. long, and weighs only 3½ ounces. Rated capacity is ½-in. mounted point or grinding wheel. Tool has ⅛-in. precision-ground collet.

A rotary valve in the all-steel tool provides speed control from 0 to 50,000 rpm. This miniature grinder is also



available in a kit which includes grinder, 3 nosepieces, 3 mounted points, 2 collet wrenches, dressing stone, 5 ft of air hose and couplings, and a fog type filter-lubricator. A second kit includes all except the filter-lubricator.

Buckeye Tools Corp., Div. 48, P. O. Box 966, Dayton 1, Ohio. **T-10-1851**

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Metallic Cutting Material

No strategic materials are required for the metallic material called New-Met. Major constituents are molybdenum and titanium.

It is considered harder than conventional carbides, easy to braze, and relatively impervious to cratering and wear. Field tests indicate it can be run successfully at speeds beyond the range of present-day machines. A high-velocity material, it can be successfully used in milling steel.

Newcomer Products, Inc., Latrobe, Pa. **T-10-1852**

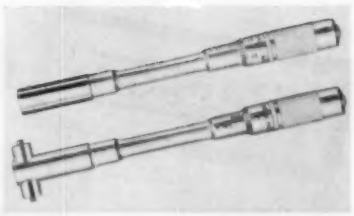
Spot Weld Sealer

Parweld spot weld elastic sealer compound was created to avoid electrode failure caused by formation of copper oxide which ordinarily occurs when the tip comes in contact with spot weld compounds. Field tests indicate an increase of electrode service life by 500 percent. The compound may be applied quickly and with a minimum of care.

The elastic sealing compound provides watertight, corrosion-free joints with minimum resistance to the welding current. Satisfactory welds are made with the spot welder set to standard conditions of 10,000 amps, 10 cycles. More than 850 welds can be made directly through the compound before pitting becomes noticeable. The sealer may air-dry up to 96 hours before welding without affecting either weld or sealing quality.

The compound will adhere without running or sagging on oiled sheets, and will hold its form to temperatures of 350 F for 45 minutes. It may be applied with conventional pressure compound equipment at 60 psi. It may be extruded in beads as small as $\frac{1}{8}$ in. and is unaffected by phosphating solutions and hot water.

Parr Paint & Color Co., 18312 Syracuse Ave., Cleveland, Ohio. **T-10-1853**



Inside Micrometers

Small diameter inside micrometers, identified as P and PX-series, are furnished in a range from 0.310 in. through 1.250 in.

Gaging tips of these inspection tools are rectangular in cross-section, permitting construction of a sturdy mechanism for checking thin grooves and recesses. The rectangular design also provides immediate centralization to a positive line-contact stop. The tool requires no rocking when checking ordinary bores, and thus may be used by unskilled personnel.

P-series micrometers have tip widths of $\frac{1}{16}$, $\frac{3}{32}$ and $\frac{1}{8}$ in. PX- series mircometers have tips widths of 0.015, 0.025 and 0.035 in.

Rimat Gage Co., 21 W. Dayton St., Pasadena, Calif. **T-10-1854**

NOTICE
to users of spindles* that need repair or rebuilding

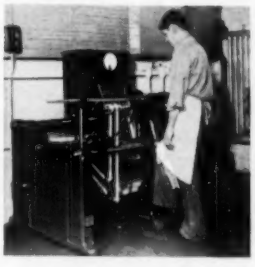
POPE — the leading builder of precision spindles IS THE BEST PLACE TO HAVE YOUR SPINDLES MADE GOOD AS NEW.

Today's grinding, milling and boring tolerances demand precision spindle performance.

Pope puts your spindles in shape *quickly*, at lowest cost. (Cost figures are promptly submitted for your approval before the work is done.)

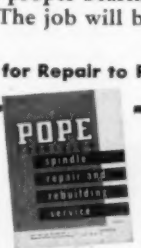
The same expert craftsmen that build Pope Precision Spindles will assemble, preload and lubricate the proper bearings and dynamically balance. The job will be done *right* the first time.

Send Your Spindles for Repair to POPE



Spindles repaired and rebuilt by POPE are assembled in an electrically air cleaned, air conditioned room. They are dynamically balanced, as pictured, to the same tolerances as new spindles. This assures better surface finishes and smoother running spindles.

* POPE Repair and Rebuilding Service applies to ANY SIZE, ANY MAKE of Anti-Friction Bearing SPINDLES.
Belt Driven
Motorized
High Cycle



POPE MACHINERY CORPORATION
261 River St., Haverhill, Massachusetts

Mail me a copy of Bulletin R-1 describing in detail Pope Precision Spindle repair and rebuilding service:

Name.....

Company.....

Address.....

City.....Zone....State.....

No. 114

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-185

Verson design, engineering and craftsmanship combine versatility with efficiency

Catalog B-55 gives design details and specifications for all Verson Press Brakes. Write for your copy, today.

This line-up of Verson Major Press Brakes is in the plant of Butler Manufacturing Company (Canada), Ltd., subsidiary of Butler Manufacturing Company. Ranging in capacity from 190 to 450 tons, these Verson Press Brakes form a production unit that combines the versatility necessary for multi-purpose manufacture with the efficiency standards necessary for profitable operation. The line currently produces special corrugated sheet steel and structural members for commercial type prefabricated steel buildings.

Verson Major Series Press Brakes, as shown here, are designed for the big jobs and represent the ultimate in strength, rigidity, accuracy and power. Their advanced design includes such features as herringbone main gears, spring loaded mechanically actuated shoe type brakes, ram adjustment motor with totally enclosed worm gear, rugged "L" type gibbing and allsteel welded frame to maintain constant alignment of bed, ram and housing, high pressure lubrication system and many others. These are the features that enable them to provide the utmost in performance, precision, production.

There are Verson Brakes for your smallest or your largest job. Write for complete information, or send an outline of your needs for specific information. Verson engineers, backed by over twenty-five years of press brake manufacturing experience, will be happy to help you.

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Men at Work

Announcement from The Ohio Crankshaft Co. has revealed appointment of **M. J. Hoke** as senior vice-president and general manager. Prior to this appointment he was vice-president and general manager of the camshaft and crankshaft division.

Two appointments recently announced by Taft Peirce Co. involved **Kenneth H. Williamson** and **Russell W. Grabinsky.** Mr. Williamson, former factory manager of Wheeler Machine Products Corp., became superintendent of Contract Service Div. Mr. Grabinsky, assistant superintendent of the Small Tool and Gage Div. until the death of J. Harold Smith when he was named acting superintendent, has been officially appointed superintendent of the division.

New chief metallurgist at The Carpenter Steel Co. is George E. Brumbach. Formerly metallurgist at Carpenter, he has extensive experience in steel mill metallurgical control and inspection.

Recent appointment of **C. A. Pafenbach** as vice-president in charge of sales has been made public by Lavalle & Ide.

Among recent promotions at Ohio Seamless Tube Div. of Copperweld Steel Co. was appointment of **Glen J. Hartman** as manager of operations; **Julius H. Clabaugh** as assistant manager of operations; **Donald R. Chew** as head of quality control; **Francis S. Coleman** as chief engineer; and **George P. Jones** as assistant chief engineer. Mr. Chew is a member of ASTE's Mansfield chapter.

Appointment of **Peter D. De Leo** as engineering consultant has been revealed by Progressive Welder Sales Co. Mr. De Leo, who joined the firm in 1945, has been chief electrical engineer.

Three announcements from Seneca Falls Machine Co. have revealed the promotions of **R. M. Wheeler, T. E. Rodgers** and **V. L. Percy.** Mr. Wheeler was made executive assistant; Mr. Rodgers became works manager; and Mr. Percy was named chief engineer.

Electro Metallurgical Co., a division of Union Carbide and Carbon Corp., has announced appointment of **Burton R. Buck** as a vice-president. Associated with the organization since 1934, he has been works manager for the past three years.

O. B. Wilson is new vice-president of Brown Instruments Div. of Minneapolis-Honeywell Regulator Co. He also will continue in his current post as general sales manager for the division.

Robert B. Heppenstall, Jr. has been appointed general manager of Heppenstall Co.'s Ring Div. and will direct both manufacture and sales of rolled and hand-forged rings. He previously was general manager of the company's Bridgeport, Conn. plant.

Valvair Corp. has revealed appointment of **Domenic A. DiTirro** as manager of research and development. In this capacity he will direct new product design, development and testing and will supervise activities of the recently establishment research and development department.

Two new appointments at Cleveland Cap Screw involved **Andrew V. Wetzel** and **Michael Stasko.** Mr. Wetzel, metallurgist for the company for the past seven and a half years, was named chief metallurgist for Cleveland Cap's two plants. Mr. Stasko, for the past three years supervisor of quality control, is now assistant to the product engineer.

Carl L. Bausch, former senior vice-president of Bausch & Lomb Optical Co., has been elected chairman of the board of the company. He has been associated with the firm since 1909.

W. H. (Hank) Evans has been elected president of Minneapolis-Honeywell Regulator Co., Ltd. He has been general manager since 1941 and vice-president and general manager since 1951.

T. S. Bonnema is new president and general manager of The Oster Mfg. Co. succeeding Roger Tewksbury who became board chairman. Previously he was vice-president and general manager.

Foster H. Pettay is new president of The Ohio Crankshaft Co. Associated with the firm since 1941, he was made a director in 1950 and became senior vice-president last year.

Post of master mechanic at Modern Industrial Engineering Co. has been filled by **Aaron E. Wilcox.** He formerly was assistant master mechanic at Packard.

Greer Hydraulics, Inc. has named **Cecil Barlow** and **Melvin Schoenberg** manufacturing superintendent and planning supervisor respectively. Prior to this Mr. Barlow was assistant vice-president, while Mr. Schoenberg was chief project engineer and administrative engineer.

Paul Jones has been made works manager of the Borg & Beck Div. of Borg-Warner Corp. For the past four years he has been plant manager of the Utica Div. of Bendix Aviation Corp.

Norman A. Price has been named executive vice-president of The Colson Corp. Prior to this, Mr. Price, who joined the organization in 1952, had been vice-president in charge of sales.

John D. Gordon has been elected to the board of Progressive Welder Sales Co. as vice-president and general manager in charge of company operations. He joined the firm last June as sales manager.

Fritz A. Zander, former vice-president in charge of manufacturing and engineering, is new executive vice-president of Micrometrical Mfg. Co. He is a member of ASTE's Ann Arbor Area chapter.

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6 cutter shapes, 12 sizes—2 grades of hardness
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have high speed steel form cutters, require only top grinding to resharpen. Hold true thread form. Rigid and "Spring" types.
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Lathe Dogs, Milling Machine Dogs, and Clamp Dogs. 12 types, all sizes.
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Heavy Duty, Medium Service, Deep Throat, and Tool Makers' types in all sizes. Also drop forged Machinists' Clamps.
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A complete line of Drop Forged Strap Clamps, Planer and Bracing Jacks and T-slot Bolts.
ARMSTRONG Drop Forged Eye Bolts
Plain or shoulder pattern. Blank or Threaded. 14 sizes. Drop Forged and heat treated.
ARMSTRONG Ratchet Drills
All steel wearing parts hardened. Packer, Railroad, Standard, and Short types, both plain and reversible
ARMSTRONG Drop Forged Wrenches
Both Carbon and Alloy Steel. Over 100 types in all sizes. Improved designs, steels, and heat treating give greater strength.
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All sizes and types with driving handles, extensions, and drop forged ratchets. Sold singly or in cased sets.
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Drill Drifts, Tool Posts, Drill Holders, Cutter Grinding Holders, and Tool Makers' Vises.
ARMSTRONG BROS.
Better Pipe Tools. A complete line, each a better tool with hardened, alloy or drop forged parts wherever they will add to strength or tool life.

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"The Tool Holder People"

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Howard S. Coleman has been elected vice-president in charge of research and engineering at Bausch & Lomb Optical Co. Dr. Coleman, who has authored more than 200 papers in his field, joined Bausch & Lomb in 1951 as director of its scientific bureau.

Fenwal Inc. has announced appointment of **Allan S. Robertson** as vice-president in charge of sales, responsible for the company's overall domestic and export marketing and sales program. Mr. Robertson formerly was with the Union Switch and Signal Div. of Westinghouse Air Brake Co.

George C. Wilsher has been made vice-president in charge of engineering at Holcroft & Co. He has headed the company's engineering department since 1945.

James F. Bere has been made general manager of the Axelson Mfg. Co., a division of U.S. Industries, Inc. For the past year and a half he has been general manager of the Hamilton, Ohio plant of Clearing Machine Corp.

Arthur G. Walsh has joined the research division staff of National Research Corp. and will serve as director of the process engineering department.

John Wallerius was recently named chief engineer at Lindberg Industrial Corp. Prior to joining Lindberg, he was president of Sigma Metallurgical Co.

Appointment of **Sol Levine** as chief engineer has been announced by Sterling Precision Corp., Instrument Div. Mr. Levine, who formerly was chief engineer of Edo Corp., is a veteran of 15 years in research, design, development, product engineering and field testing of electronic and electro-mechanical instruments.

technical Shorts

Develop Process For Spray Coating With Ceramics

It is becoming commercially practical to spray protective coatings of ceramics and high melting-point metals as a result of recent developments in application equipment and materials. This new process for metallizing services, developed by Metallizing Engineering Co. of New York, is called Thermospray. Materials in fine powder form are sprayed at comparatively high speed with high deposit efficiency. Sprayed coatings of high temperature ceramics like alumina and zirconia offer high heat resistance, abrasion resistance and electrical insulation for a wide variety of industrial applications.

Cermets, combinations of powdered ceramics and metals, and self-fluxing alloys also are included in the expanded range of materials now available for protective sprayed coatings. Such coatings can save industry time and money in the replacement of expensive components.

Applications are under test on parts subjected to extreme heat in military weapons and engines, according to Knowles Smith, executive vice president of Dix Engineering Co., a contractor for this metallizing service.

Special Nut Tightens Under Vibration

A new nut designed by Guest, Keen and Nettlefolds (Midlands) Ltd. of Birmingham, England, tightens instead of loosening under vibration. It comprises a stack of resilient metal disks assembled in a hollow nut body. When first screwed onto the bolt, the nut is free moving, but as the nut is tightened against the abutments the stack of conical disks undergoes axial compression. Outer edges of the disks are forced slightly outward and stretched, but are supported by the nut body acting as a pressure ring. The inner edges of the disks are shortened by the deflection until the threads cut in them contact both flanks of the thread of the bolt.

Wedge-like inward pressure of the fully tightened elastic nut against both flanks of the thread of the bolt is proportional to the prestress in the bolt. Vibration increases the pressure, and the nut is tightened instead of unscrewed. The nut may be unscrewed, however, or adjusted whenever required.

Silicate Base Sand Binder For Mold Cores

Development of a new silicate-based sand binder for production of molds and cores, called Moroc, has grown out of research and laboratory exploration conducted jointly by Diamond Alkali Co. and The Delhi Foundry Sand Co. This new substance will not separate in storage, has a low viscosity that permits easy mixing, offers good bench life, excellent gas reaction, good storage life of the finished cores and good collapsibility. Small to medium-size cores made with the material can be cured in ovens.

It also produces molds and cores with high dimensional accuracy, and makes castings with good finish.

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TRADE literature

For Free Booklets and Catalogs — Convenient Request Card on Page 167

Chucks

Spiral-bound, 61-page Catalog No. 66-1956 presents complete line of manually operated chucks; includes detailed dimensional drawings and tables, gives description of each item, pointing out important features and recommended uses; tab indexed for quick, easy references. Cushman Chuck Co., Hartford, Conn. **L-10-1**

Centers

Comprehensive 16-page Catalog No. CD-56 of Red-E line of cylindrical grinding machine, lathe centers and grinder dogs, includes data needed to simplify proper selection of these machine tools; well illustrated; lists dimensions and specifications. Ready Tool Co., 554 Iranistan Ave., Bridgeport 5, Conn. **L-10-2**

BARNESDRIL

COOLANT FILTERS

give you 2 Stage* COOLANT CLEANING

For Selective Degree of Coolant Clarity

BarnesdriL Engineers provide two distinct stages in coolant cleaning. The new Kleenall Unit *combines practical magnetic separation for removal of ferrous particles, *with positive cleaning by filtration to eliminate non-ferrous or other objectionable foreign matter. With control inherent in this method it is possible to give you the exact degree of coolant cleanliness that is practicable for your production operations.

Complete Lab Facilities for Your Convenience

Typical microphoto of composite swarf from a high production cutting operation.

In their modern coolant laboratory, these engineers can precisely measure waste particles and classify them by physical types. Percentage of contamination is thus determined, and they are then able to select a filter medium and unit to give you the degree of coolant clarity desired.

Ask a BarnesdriL representative today for an analysis of your coolant cleaning problems and recommendations for the most practical solution.

Write for Catalog 350G

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Fluid Power

Twenty-page brochure, "How Fluid Power Serves Industry and You" published by National Fluid Power Assn. to describe part fluid power plays in mechanical progress. Available from Miller Fluid Power Div., 2040 N. Hawthorne, Melrose Park, Ill. **L-10-3**

Mill Bearings

Line of catalogued heavy duty mill bearings designed for operating conditions where severe radical and thrust loads are expected, are described in illustrated 8-page Book 2665; includes dimension and rating data. Link-Belt Co., Dept. PR, Prudential Plaza, Chicago 1, Ill. **L-10-4**

Electrolytic Grinding

Engineering Bulletin No. 300, "Suggestions for Modification of Standard Grinding Machinery to Anocut Electrolytic Grinding Equipment," outlines procedures for adapting any standard grinder for use with the Anocut process; text is supplemented by cutaway drawings, exploded views and parts recommendations. Anocut Engineering Co., 631 W. Washington Blvd., Chicago 6, Ill. **L-10-5**

Magnetic Controls

Eight-page booklet TD 52-760, "Cypak Magnetic Control," discusses this new control and logic functions for industrial control; illustrated with photos, drawings and circuit diagrams. Westinghouse Electric Corp., P.O. Box 2099, Pittsburgh 30, Pa. **L-10-6**

Tube Fittings

Illustrated 4-page folder presents advantages and features of O-ring tube fittings which eliminate need for flaring, threading, welding or soldering; includes dimension lists. Lenz Co., 3301 Klepinger Rd., Box 1044, Dayton 1, Ohio. **L-10-7**

Wet Blasting

Series of illustrated folders describe variety of applications for wet blasting process; covers deburring, selection of abrasives, finishing of molds and dies, honing cutting tools, carbide inspection, and other pertinent points. Cro-Plate Co., Inc., 747 Windsor St., Hartford, Conn. **L-10-8**

Cutting Fluids

Booklet entitled "Cutting and Grinding with Johnson's Wax Cutting Fluids" describes properties of wax as they assist cutting functions; explains how wax lowers temperatures and increases tool life; also contains comparative machinability table as guide to selecting correct coolant for every grade of metal. Industrial Products Dept., S. C. Johnson & Son, Inc., Racine, Wis. **L-10-9**

Furnaces

Twelve-page Bulletin No. 461 describes and illustrates company's tool hardening or preheat furnaces; includes discussion of main features of each type and list of specifications. C. I. Hayes, Inc., 800 Wellington Ave., Cranston 10, R. I. **L-10-10**

Industrial Controls

Bulletin GEA-6334, extensively illustrated, 12-page, offers concise application information on Pan-A-Trol packaged control for industry, and lists special benefits in engineering assistance, design, installation, maintenance and field service offered by General Electric Co., Schenectady 5, N. Y. **L-10-11**

Surface Plates

Step-by-step instructions for surface plate calibration after it has been installed are included in brochure containing article on "How to Calibrate Surface Plates in your Plant" by J. C. Moody of Sandia Corp. Collins Microflat Co., 2326 E. 8th St., Los Angeles 21, Calif. **L-10-12**

Lubrication Equipment

Complete information on spray lubrication systems for open gearing and slide surfaces presented in illustrated 8-page Bulletin No. 60; covers manual and automatic systems and component equipment with schematic layouts plus application views. The Farval Corp., 3249 E. 80th St., Cleveland 4, Ohio. **L-10-13**

Electric Clutches, Brakes

Four-page leaflet describes and illustrates miniature and small electric clutches and brakes, pointing out features and advantages; includes dimensional drawings and specification tables. Simplatrol® Products Corp., 24 Salisbury St., Worcester, Mass. **L-10-14**

Hydraulic Valves

Mechanical Data Book, illustrated with photos, charts and drawings, contain technical information on installation and maintenance of oil-relief, bypass hydraulic valves. Fulflo Specialties, Co., Inc., Blanchester, Ohio. **L-10-15**

W-T ALKER-TURNER

COMPARE — You'll see that you get a lot more for your money when you buy W-T "Light-Heavyweights"!

Another NEW "Light-Heavyweight"! — cuts bars, rods, tubing . . . and production time!

This newest machine in Walker-Turner's "LIGHT-HEAVYWEIGHT" line makes mighty short work of cutting bars, rods and tubing. The abrasive wheel cuts true and clean — saves time for you with every cut it makes and frequently eliminates finishing operations.

You can tap the cast-iron table to mount any work-holding devices you want. We furnish a template to drill for angle-mounting of the head — or it can be factory-mounted at 45° for miter cutting.

Walker-Turner "Light-Heavyweight" Abrasive Cut-Off Machine: Capacity: 1-1/2" round bar; 3" tubing. Abrasive wheel, 12" dia. x 3/32", on 1" spindle. Speed, 3720 rpm, 11,710 fpm. Heavy guard provides 216° peripheral protection; easily removed for wheel change. 3 hp. 220/440 v. 3-phase motor — fan-cooled, totally enclosed, ball-bearing, overload capacity up to 7 hp.

. . .

Write or cable for full information and specifications on this and other "Light-Heavyweight" Machine Tools.

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NFPA NATIONAL FLUID POWER ASSOCIATION

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Carbide Tools

Complete line of carbide tools presented in illustrated brochure; includes descriptions, specifications and prices. Schmarje Tool Co., Muscatine, Iowa. **L-10-16**

Centrifugal Pumps

Illustrated brochure, Form 7223-B, describes various models in line of CRV cradle-mounted centrifugal pumps of capacities of from 5 to 2800 gpm; gives application information and typical installation views; includes performance tables and dimensions. Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y. **L-10-17**

Aluminum

Comprehensive 176-page reference handbook on aluminum alloys and mill products presents data in concise, easy-to-follow tabular form; includes information on alloy standards, and properties, sizes and tolerances of mill products; other sections deal with wrought alloys; sheet and plate; wire, rod and bar; extrusions; tube and pipe; electrical conductor; structural shapes, forgings, and casting alloys. Request "Alcoa Aluninum Handbook" only on company letterhead directly from Aluminum Co. of America, 781 Alcoa Bldg., Pittsburgh 19, Pa.

Swaging Machines

Complete line of swaging equipment presented in illustrated brochure No. SM56 which contains basic technical information about rotary swaging process, its principles of operation and advantages as a precision production method; explains typical and also unusual applications; includes specifications. The Fen Mfg. Co., Newington, Conn. **L-10-18**

Carbide Blanks

Wide range of carbide blanks for any cutting need listed in 12-page Catalog 851C; includes data on sizes, styles and shapes, and lists prices. Besly-Wells Corp., 851 Dearborn Ave., So. Beloit, Ill. **L-10-19**

Hydraulic Valves

Up-to-date factual information on oil hydraulic valves for controlling fluid power when used to control operation of cylinders and motors contained in Catalog H-12; outlines performance data, capacities, types, sizes and other pertinent details; illustrated by photos of typical installations, cutaway drawings and flow schematics. Request only on company letterhead to H. S. Thompson, The Commercial Shearing and Stamping Co., 1775 Login Ave., Youngstown 1, Ohio.

Speeds-Feeds

Chart tabulates safe feeds and speeds for high-speed drills for use in cast iron, bronze or brass and drop forgings, alloy steel and tool steel annealed. Request only on company letterhead direct to Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.

Injection Molding

Bulletin 565 describes design features of new Model 701 2-oz automatic injection molding machine; extensively illustrated, particularly with close-up photos of complete sequence of automatic ejection and degating; includes specifications; also discusses company's advisory service for plastics molders. F. J. Stokes Corp., 5500 Tabor Rd., Philadelphia 20, Pa. **L-10-20**

Valve Templates

Tracing templates to aid draftsmen in drawing 24 valves contain top, side and front views in one-quarter, one-half and full size. Mr. Jack Neun, Marketing Manager, Ross Operating Valve Co., 120 E. Golden Gate Ave., Detroit 3, Mich. **L-10-21**

Flexible Couplings

Chart contains data aimed toward simplifying selection of right flexible coupling for specific job. Industrial Sales Div., Morse Chain Co., Ithaca, N.Y. **L-10-23**

Progressive Dies and Tools

Twenty-page brochure describes progressive dies and tools; also presents case histories on the manufacture of these products as well as jigs, fixtures, gages and special machinery; well illustrated. B. Jahn Mfg. Co., Cherry St., New Britain, Conn. **L-10-24**

Honing

Extensively illustrated, revised "Microhoning Service and Equipment" catalog offers information on the Microhoning technique and discusses its advantages; describes machines used for honing various parts with guide specifications and work capacity charts for each type unit; also covers services and aids available from the company. Micromatic Hone Corp., 8100 Schoolcraft Ave., Detroit 38, Mich. **L-10-25**

Thermostats

Physical, electrical and performance data for both miniaturized and surface-mounted thermostats presented in easy-to-read form in Catalog MC-124A; also includes summary of design and installation factors which can affect control accuracy. Fenwal Inc., Ashland, Mass. **L-10-26**

Cut DIE COST WHERE IT COUNTS MOST...

...BEFORE the die gets in the toolroom

Nothing makes a diemaker meaner than a sticky punch holder. Count the number of times he removes that holder building up a die and it's foolish to save a few dollars buying second-rate die sets.

That can't happen with Detroit Die Sets because . . .

. . . from start to finish, under one roof, Detroit Die Sets are continuously inspected for accuracy, whether it's turning a shank or superfinishing a guide pin. Misalignment doesn't have a chance.

. . . we are constantly working to improve our die sets. Recently developed ball bushings are an example. Extensive testing, in our own and customers' plants, has proven their value on certain applications. Now, they're available on Detroit Die Sets to extend production runs as well as making the diemaker's job an easier one.

Details on the use of ball bushings plus other helpful information on cost-cutting Detroit Die Sets are available upon request. Write today, or see your local representative—he's as near as your phone.

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who's meeting and where

Oct. 4-6. MAGNESIUM ASSN. Annual meeting, Drake Hotel, Chicago. For details contact association office, 122 E. 42nd St., New York 17, N. Y.

Oct. 8-10. AMERICAN SOCIETY OF LUBRICATION ENGINEERS and AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Lubrication conference, Chalfonte-Haddon Hall, Atlantic City, N. J. Obtain other details from ASLE office, 84 E. Randolph St., Chicago 1, Ill.

Oct. 8-12. AMERICAN SOCIETY FOR METALS. National metal congress and exposition, Public Auditorium, Cleveland, Ohio. Obtain further facts from society headquarters, 7301 Euclid Ave., Cleveland 3, Ohio.

Oct. 8-12. AMERICAN WELDING SOCIETY. Fall technical meeting, Hotel Cleveland, Cleveland, Ohio. Write for information to society office, 33 W. 39th St., New York 18, N. Y.

Oct. 10-11. THE MATERIAL HANDLING INSTITUTE, INC. Fall meeting, The Traymore Hotel, Atlantic City, N. J. For details contact institute office, One Gateway Center, Pittsburgh 22, Pa.

Oct. 11-12. AMERICAN SOCIETY FOR QUALITY CONTROL. 11th midwest quality control conference, at the Hotel Leamington, Minneapolis, Minn. Request additional conference information from conference secretary, Robert Keane, P.O. Box #4337, Minneapolis.

Oct. 11-12. NATIONAL FOUNDRY ASSN. Annual meeting, Sheraton-Cadillac Hotel, Detroit, Mich. Details available from association headquarters, 53 W. Jackson Blvd., Chicago 4, Ill.

Oct. 15-16. AMERICAN MACHINE TOOL DISTRIBUTORS ASSN. Annual meeting, Broadmoor Hotel, Colorado Springs, Colo. Write association office, 1900 Arch St., Philadelphia 3, Pa. for other data.

Oct. 18-19. NATIONAL CONFERENCE ON INDUSTRIAL HYDRAULICS. Sherman Hotel, Chicago, Ill. For more facts, contact Raymond D. Meade, executive secretary, National Conference on Industrial Hydraulics, Technology Center, 3300 S. Federal St., Chicago 16, Ill.

Oct. 18-20. FOUNDRY EQUIPMENT MANUFACTURERS ASSN. INC. Annual meeting, Greenbrier, White Sulphur Springs, W. Va. Association office, One Thomas Circle, Washington 5, D.C. can provide details.

Oct. 22-24. AMERICAN STANDARDS ASSOCIATION. National conference on standards, Hotel Roosevelt, New York, N. Y. Direct inquiries to association office, 70 E. 45th St., New York, N. Y.

Oct. 25-26. NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS. Fall meeting, Greenbrier Hotel, White Sulphur Springs, W. Va. More information is available from society headquarters, 2029 K St., N.W., Washington 6, D. C.

Oct. 28-31. AMERICAN GEAR MANUFACTURERS ASSN. Semiannual meeting, Edgewater Beach Hotel, Chicago, Ill. For more information, write association office, One Thomas Circle, Washington 5, D.C.

Oct. 28-Nov. 1. ELECTROCHEMICAL SOCIETY. Meeting at Statler Hotel, Cleveland, Ohio. Other facts may be had from Ruth G. Sterns, managing editor, *Journal of The Electrochemical Society*, 216 W. 102nd St., New York 25, N. Y.

Oct. 30-Nov. 1. NATIONAL FLUID POWER ASSN. Fall meeting, Hotel Cleveland, Cleveland, O. Details may be had from association office, 1618 Orrington Ave., Evanston, Ill.

Oct. 31-Nov. 2. GRAY IRON FOUNDERS' SOCIETY, INC. 28th annual meeting, Homestead, Hot Springs, Va. Details are available from society office, 930 National City, E. 6th Bldg., Cleveland.

Nov. 1-2. SOCIETY OF AUTOMOTIVE ENGINEERS. Diesel engine meeting, Drake Hotel, Chicago, Ill. Write to society office, 29 W. 39th St., New York 18, N. Y. for more information.

Nov. 1-4. NATIONAL TOOL & DIE MANUFACTURERS ASSN. Annual convention, Statler Hotel, Hartford, Conn. Further information is available from society association headquarters, 907 Public Square Bldg., Cleveland 13, O.

Nov. 26-30. INTERNATIONAL AUTOMATION EXPOSITION, New York Trade Show building, New York, N. Y. Complete information may be had from Richard Rimbach Associates, 845 Ridge Ave., Pittsburgh 12, Pa.

Buck AJUST-TRU CHUCKS

"Hold O.D. and I.D. within .001" day in and day out."

Buck Ajust-Tru chucks are ideal for precision grinding. Most recent report is from Mr. Chester Nelson, Supt. Press & Machine Div., J. I. Case Company, Bettendorf, Iowa. He writes—"The part has been O.D. ground on a Centerless Grinder first, then the I.D. is ground by being held in the six (6) jaw Buck Chuck. The accuracy of the Buck Chuck is used to its fullest extent since the O.D. and I.D. have to be concentric within .001" total indicator runout. This tolerance is being held constantly day in and day out."

You, too, can handle precision grinding faster and at less cost with Buck Ajust-Tru chucks. Takes but a moment to send for literature—write today.

Do you use Power Chucks?

Ask for information about the new Buck standard and Compensating chucks — up to 12".

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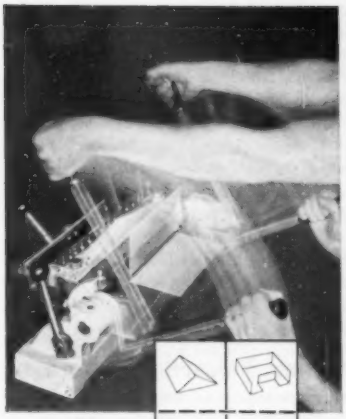

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abstracts of FOREIGN LITERATURE

By M. Kronenberg
Consulting Engineer

Chip Formation and Disposal

Chip formation and the effect of chip breakers on the generation of various types of chips are described in an article by E. Waldmeyer in the Swiss magazine *Technica* of June 22, 1956. Three ways, desirable from the standpoint of disposal, are open to shop men to control the formation of chips. These are: reduction of the true rake to obtain short chips, grinding of chip breakers and attaching chip formers.

Which one of these ways should be selected for best performance will depend on three other factors; namely, the type of material being cut, the type of operation (roughing or finishing) and tool geometry. Data tabulated in the article show the effect of the reduction of true rake on cutting forces. Included are radial and tangential forces and chip compression—a concept known in USA by its inverse value; namely, cutting ratio and wear land.

Another table of interest contains standards for chip breakers for various types of steel, depth of cut and feed. The article also illustrates several types of chip breaker grinding machines of Swiss origin, some of which automatically operate with several grinding wheels for rough grinding, lapping and chip-breaker grinding.

American and European carbide tip clamps are discussed as well as an adjustable chip former or deflector which projects above the top surface of the toolholder as much as the height of the toolholder. The author comments on throwaway tool bits, assuming that the lack of skilled operators for tool grinding in USA has been responsible for the rapid development of throwaways.

Tooling for Rock Cutting

Although metal-cutting has made great strides since Taylor's investigations at the turn of the century, comparatively little is known about cutting speeds, feeds and other quantities involved in boring of rocks in mines. This branch of industry which plays an

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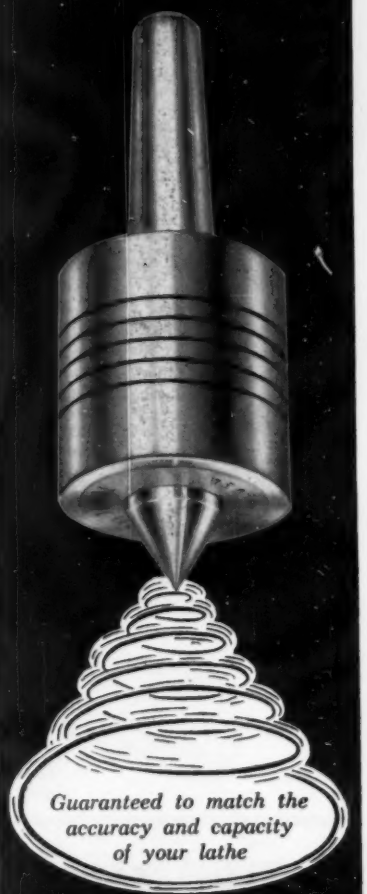

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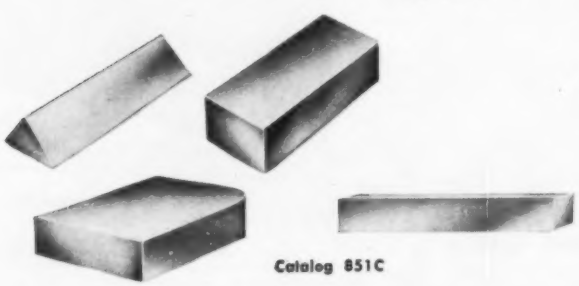

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important role in the economy of a country has long been neglected by the tool engineer according to an article in Vol. 13, No. 1 of *Technische Mitteilungen Krupp* published by W. Borschel. Cutting speeds for boring soft, hard and medium-hard rocks, marble and other stones are discussed, tool life investigations are covered and data on the tool geometry for carbide tools.

The author indicates that, similar to the machine tool industry, development of machines for the mining industries depends now on carbide tools that have been made available.

Physical Properties of Carbides

Temperature of carbide tools should be less than 1470 F at a distance of 0.020 inch from the cutting edge according to findings of J. Hinnueber on carbide tool research. These are published in Vol. 13, No. 3 of *Technische Mitteilungen Krupp*. If necessary to employ higher temperatures, carbide tools with high titanium-carbide content should be used; they carry the designation TT 1 and TT 2 in German carbide tool standards.

In addition to bending stresses, carbides are subjected to compressive stresses. The author indicates that tools should preferably be designed so that the high compressive strength of carbides can be fully utilized. The compressive strength is, however, greatly affected by the cutting temperature, dropping from 330,000 psi at room temperature to about 70,000 psi at 1830 F for the high titanium carbide alloy (TT 1) and 0.2 percent compression limit. By comparison, a low titanium carbide tool (TT 4) has a compressive strength of 170,000 psi at room temperature, dropping to 42,500 psi at 1830 F. To compare physical properties of carbides with those of high-speed steel, the author limited the temperature to 1380 F. He concluded from the tests that the compressive strength, at 0.2 percent compression, was 50,000 psi for high-speed steel, 140,000 psi for carbide TT 4, and 230,000 psi for TT 1 carbides.

If the cutting speed is too high and the cutting temperature accordingly exceeds these values, the cutting edge fails under compression. In interrupted cuts tools are subjected to substantial changes in temperatures, causing cracks in a direction normal to the cutting edge. In particular this happens in milling and profile turning operations. Coolants increase the danger of such cracks because stresses of 570 psi are developed for each degree of sudden drop in temperature. To reduce the heat shock at the instant of starting a cut, expensive and heavy tools should be preheated to a temperature of about 200 F. Likewise, reducing the lead

angle, or increasing the side cutting edge angle, is recommended for reducing the heat shock.

The author has run tests to find a correlation between cratering of the tips and progress of oxidation of the various metals composing a carbide tool. At about 1470 F the oxidation of all alloys is rapid and hence formation of craters accelerated. At these temperatures the crater rather than the wear on the tool flank is the cause of tool failure.

In view of the trend of increasing cutting speeds the author concludes that vibrations are particularly detrimental to the life of carbide tools. He found a drop of as much as 50 to 75 percent when the tool was vibrating, in comparison with a smooth cutting tool.

Finish Rolling

Finish rolling has been used for a great number of years in machining axles for railroad cars. The process has also been extended to machining bedways on some machine tools. THE TOOL ENGINEER, December 1953, page 57. Recent developments in this field are discussed in an article by H. Koenig published in *Werkstattstechnik und Maschinenbau*, June 1956. This is limited to finish rolling of round workpieces and bores. Dimensions of the workpiece have an important effect on the method of finish rolling to be used. For small diameters, where several rollers can be used for the process, the transmission of power from roller to roller and through the workpiece is such that no external forces are present that would deflect machine parts and thus reduce the accuracy of the finished part.

Conditions are less favorable for larger workpieces where only one roller can be used; then the forces may deflect the machine and precautions are needed to avoid increasing the pressure beyond a predetermined limit. Furthermore, the author indicates, finish rolling is particularly effective in producing good surface finish on carbon steels, although cast iron and nonferrous metals offer few difficulties. Finish rolling after heat treatment, however, is not recommended. The two main quantities to be taken into consideration are rolling force and roller adjustment. The rollers can be adjusted for "plunge" rolling operations or for "feed" rolling operations depending on qualities of the material and geometrical contours of the workpiece.

Numerous machines and tools are depicted by drawings and photographs, among them attachments for lathes, special machines for the manufacture of axles for locomotives, hydraulically operated rolling devices, machines for finish rolling of barstock, tools with inserted rollers for finish tooling of bores and others.

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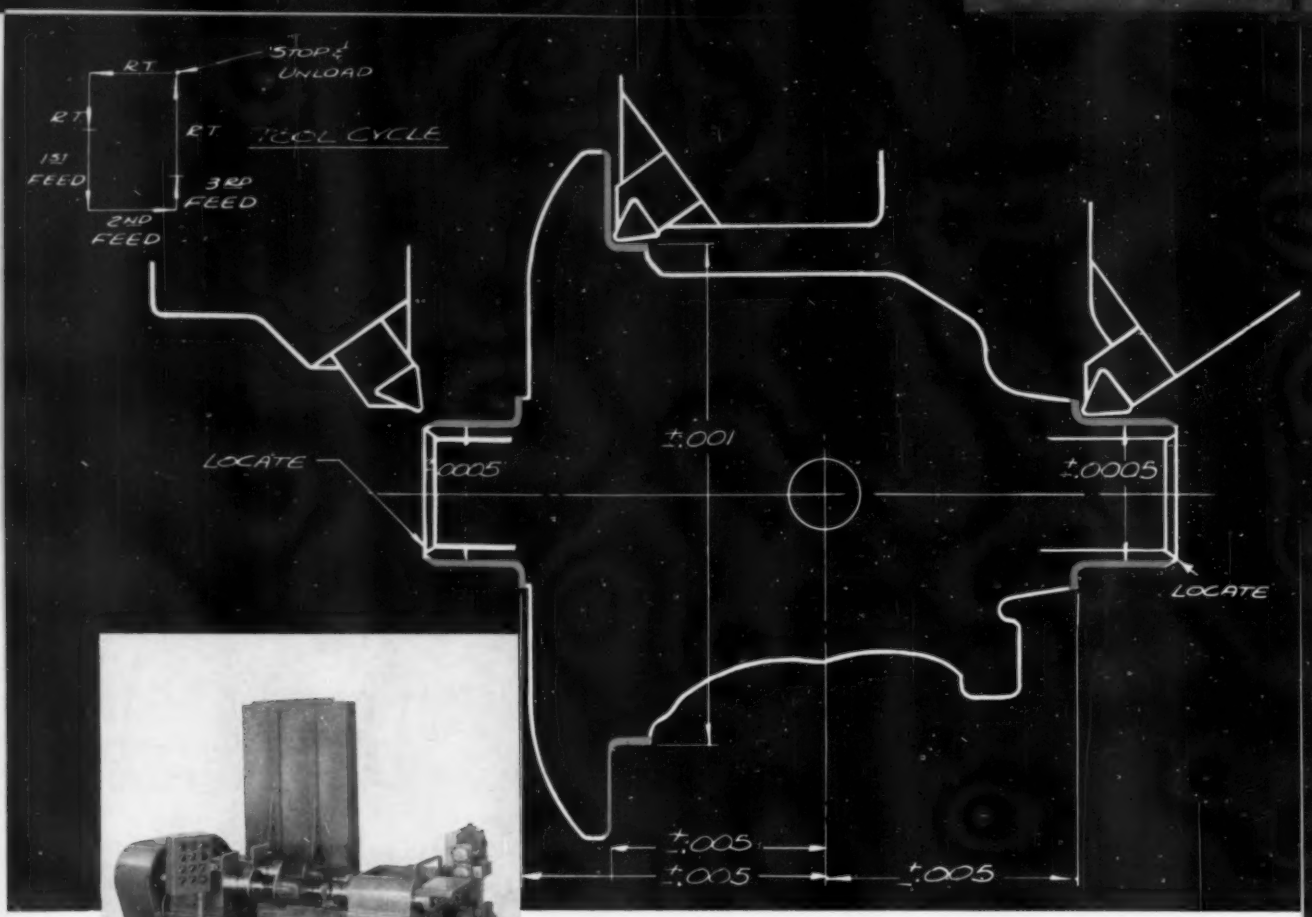
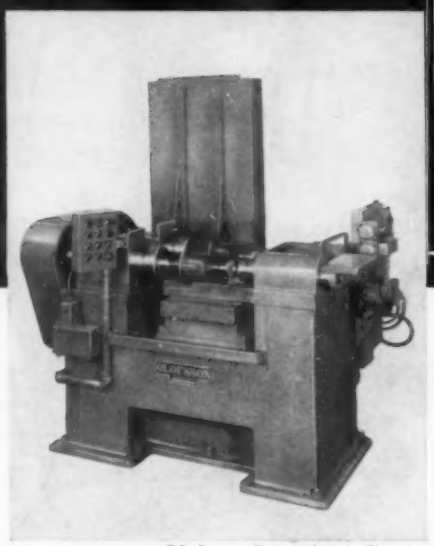
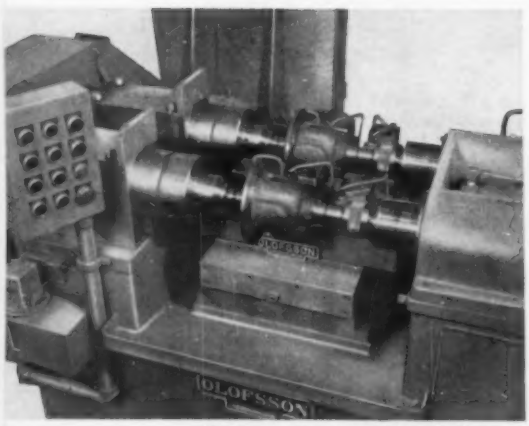




Olofsson Special two-Station Precision Lathe.



Close-up view of differential cases clamped into position.

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For example, this *2 Station Precision Lathe* can finish face and turn two hubs, and finish face and turn the flange on an automobile differential case, cast of cylinder iron, *at the rate of 60 per hour.* This production is possible because the design reduces operator fatigue and human error, provides push button operation.

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FIELD notes

Smithsonian To Set Up Hall of Tools

The United States National Museum, the Smithsonian Institution, is currently on a search for material for its collections and exhibits to demonstrate the importance of engineering to the growth of civilization. One section of the project, devoted to tool engineering, will be displayed in the Hall of Tools.

It is planned that historical exhibits will show development of hand, mechanical, power, precision and automatic tools. In this connection, the Museum is searching for originals, models or replicas of old tools that would be included in those five categories, especially of those tools which mark a fundamental advance in development. Tools of which the date and maker can be adequately documented are particularly desired. In addition, the Museum wants to obtain drawings, photos, plans, etc. of old tools as well as collections of professional papers, photos and other pertinent material of men and firms who played important parts in development of the tool industry. Robert S. Woodbury, curator of the division of engineering of the Museum in Washington, D.C. should be contacted concerning exhibit specimens or the displays.

First laboratory in the United States for instruction in shaped diamond tool technology has been established at Illinois Institute of Technology under a $30,000 grant from Industrial Distributors, Ltd. of Johannesburg, South Africa. A course, designed to instruct industry in construction and use of shaped diamond tools will cover selection of diamonds for various uses, sawing and shaping diamonds for tools, and turning, boring and wheel dressing. The course, conducted during the evening, is being offered for the first time this fall.

v v v

A Cobalt Information Center has been established at Battelle Institute. Purpose of the Center is to encourage cobalt research, and to provide technical and economic information for users in the metallurgical, chemical, ceramics, electronics, pharmaceutical and nucleonics industries.

new facilities

Engineering and manufacturing facilities have been established at 4755 E. 49th St. in Los Angeles by Clark Controller Co. Manufacturing operations at first are consisting primarily of engineering and assembly of special control panels and motor control centers.

A $4-million aeronautical plant is to be erected near St. Petersburg, Fla. by Minneapolis-Honeywell Regulator Co. to develop and produce aerial navigation equipment known as inertial guidance systems. According to the announcement, about 1,500 engineers and skilled production personnel will be employed when full-scale production is reached at the new plant, probably by mid-1957.

v v v

Square D Co. has scheduled construction of a $3-million electrical plant in Lexington, Ky. One-third of the amount is earmarked for equipping the 150,000-sq-ft facility with the most modern, high-production machinery. Completion of the project is expected in one year. An initial requirement of several hundred employees is anticipated. Meanwhile, the company is launching pilot operations in Lexington and has leased a 12,500-sq-ft building for assembly of special panelboards and switchboards for regional markets.

v v v

Plans have been finalized by Harvey Aluminum for construction of a 54,000-ton aluminum reduction plant at The Dalles, Ore. Work at the 500-acre site, interrupted four years ago has been resumed, and the plant is scheduled for completion late in 1957. According to present plans, the company will increase capacity of the plant by 13,000 tons in late 1958. A further long term program calls for construction of an 130,000-ton alumina plant and a second reduction plant of 67,000 tons annual capacity during 1960-63.

At the same time, Harvey also announced details of an interim five-year agreement for alumina with Nippon Light Metal Co., Ltd., and Sumitomo Chemical Co., Ltd., largest producers of alumina in Japan.

v v v

Wesson Multicut Co. is erecting a new plant in Brighton, Mich. which will be devoted solely to production of special tools. This will be the fourth Wesson expansion in the past two years.

v v v

Brooks & Perkins, Inc. has opened a new West Coast Engineering Div. at 11655 Vanowen St., North Hollywood, Calif. The division, which is equipped to handle complete engineering programs including product design, and, in the near future, building of prototypes, is under the new manager of engineering, Donald L. Erickson, who formerly was chief production engineer for the company at its main plant in Detroit.

corporate changes

Allegheny Ludlum Steel Corp. has contracted to purchase Paul R. Repath, Inc., a West Coast producer of electrical steel laminations, metal stampings and deep drawn transformer cans. Allegheny Ludlum's wholly owned subsidiary, The Arnold Engineering Co., will operate this plant as Repath Pacific Div. of Arnold Engineering. Paul R. Repath, who founded the firm in 1930, will continue to direct its activities.

v v v

U. S. Industries, Inc. has acquired all assets of Western Design & Mfg. Corp. in return for payment of approximately 30,000 shares of USI common stock. It will be operated as the Western Design & Mfg. Corp. Div. The transaction was made to gain entree for U. S. Industries into the engineering, design and manufacturing of jet aircraft and guided missile systems field.

v v v

Acme Steel Co. has agreed to purchase property and net assets of Newport Steel Corp. subject to approval of Newport stockholders. Upon completion of the purchase, Newport will be operated in its present locations at Newport and Wilders, Ky. as a division of Acme Steel. Steelmaking facilities at Newport

have an annual ingot capacity of 600,000 tons from open hearth and electric furnaces, with blooming and finishing mills for producing hot and cold rolled sheets, electric-weld line pipe and specialties, none of which are made by Acme Steel.

v v v

Van Norman Industries, Inc. has arranged to acquire 17,128 shares of The American Pulley Co. common stock, and thus become that firm's largest single stockholder.

The Yonkers research and laboratory facilities of Schwarzkopf Development Corp. (formerly American Electro Metal Corp.) have been acquired by Firth Sterling Inc. The facilities will be operated as the American Electro Metal Div., Firth Sterling, Inc.

At the same time a license agreement in the field of cemented tungsten carbides was concluded between the two companies. The firms also are jointly interested in Borolite Corp. which makes products for ultra-high temperature applications.

Permission to merge McKay Machine Co. and Metal Processing Machine Co. has been approved. The latter firm will operate as a subsidiary of McKay with coordinated, but not integrated sales and engineering staffs.

v v v

Sale of all Westcott assets to the newly formed Oneida Machine Tool Corp. was announced recently.

moves

The American Zinc Institute, Inc. has moved its headquarters to larger offices in Suite 2020 of the Lincoln Bldg., 60 E. 42nd St., New York 17, N.Y.

v v v

West Coast Div. of Allmetal Screw Products Co., Inc. has moved to larger quarters at 2978 Wilshire Blvd., Los Angeles, Calif.

v v v

Move of The S-P Mfg. Corp. to the new plant in Solon, Ohio, has been completed. The new facility provides housing for all engineering and manufacturing operations as well as the executive offices.

v v v

New address for Lead Industries Association is 60 E. 42nd St., New York 17, N.Y.

new ventures

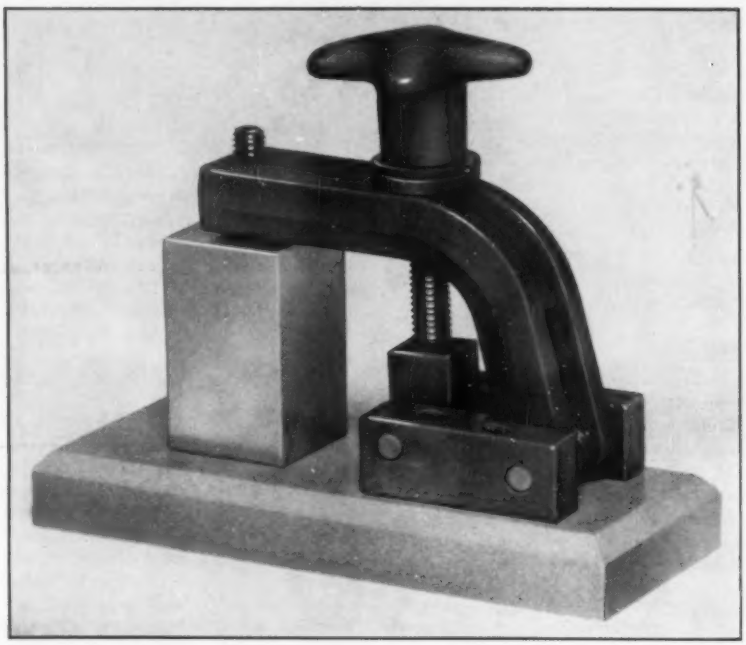
Godderz Engineering Co. has been formed to provide a general tool and engineering service to industry in the Middle West. The firm also will specialize in tooling for multiple spindle machines and the design of special multiple spindle machines. Offices have been opened in Suite 609, Calhoun Bldg., 711 W. Lake St., Minneapolis 8, Minn. H. G. Miller, co-founder of the firm with D. L. Godderz, is a member of ASTE's Twin Cities chapter.

v v v

Concord Control Inc. has been established to produce numerical control systems. New plant for the organization will be in operation October 1 at 1282 Soldiers Field Rd., Boston, Mass.

v v v

Formation of Thermo Materials, Inc. under the joint ownership of Gladding, McBean and Co. has been announced. The plant will occupy a 2½-acre site near Menlo Park, Calif., while offices



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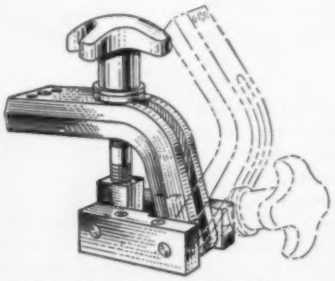

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have been located at 1275 Harrison St., San Francisco. The plant, specializing in development and production of high temperature industrial ceramics, is expected to be in production by December.

v v v

Opto-Metric Tools, Inc. has been organized and will specialize in domestic and foreign optical measuring tools with a nationwide sales and service organization. Fritz Koenig, formerly associated with Geo. Scherr Co., is president and general manager of the new firm.

v v v

The Ajax Composite Die Co., a new corporation headed by K. J. Puffer, has begun production of composite dies, recently discontinued by the Ajax Steel and Forge Co.

v v v

An ultrasonic impact grinding service for close-tolerance orifices in hard and brittle materials is being offered to industry by C-Mar Corp. The service has diverse industrial applications ranging from fabrication of carbide dies to engraving of decorative glassware.

new trademark

Maraset has been registered by Marblette Corp. as a new trademark for its line of epoxy resins in order to differentiate between these products and the phenolics. The designation was selected to retain company identification while making the desired distinction. Product lines now will be referred to as Marblette phenolic resins and Maraset epoxy resins.

expansions

Capacity of its entire plant will be approximately doubled when the new expansion program is completed for Vanadium-Alloys Steel Co. Besides the additional space, plans call for installation of new 10, 12 and 16-in. rolling mills plus necessary equipment for their operation. It is expected that the new facility will be in operation by the latter part of 1957.

v v v

Long-range program of improvement of plants and facilities on both coasts and in England has been announced by Standard Pressed Steel Co. In this connection, a new top-management post, director of plant improvement, was created, and filled by appointment of Frank G. Kaufman. Mr. Kaufman is vice-president in charge of product engineering for The Cleveland

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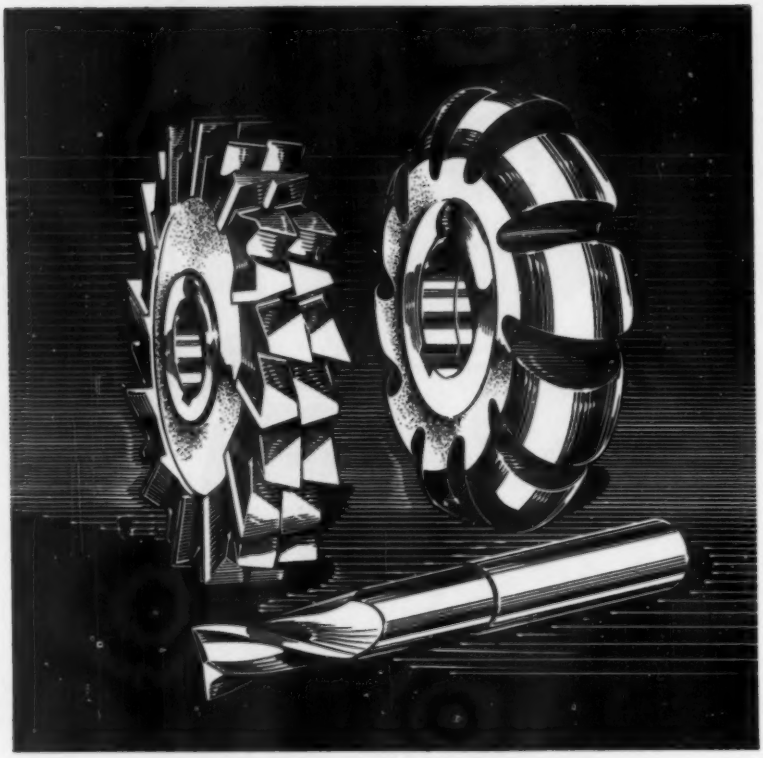

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If they are someone ought to tell our customers about it. They've asked us to produce so many styles and sizes that we finally went all the way and stock the most complete line available anywhere.

No, the solid high-speed steel cutters haven't been obsoleted by the carbides. When it comes to the smaller production runs and toolroom use, the solid steel cutters are *it*. Here, they'll perform more than adequately at the lowest possible initial tool cost. And they're much easier to maintain than the more costly carbide cutters.

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Cap Screw Co., a SPS subsidiary. He has been supervising construction and machine selection at the Cleveland Cap's $5-million plant now nearing completion.

v v v

Construction of a $6-million electric furnace shop at its Roemer Works in Farrell, Pa. is announced by Sharon Steel Corp. The new facility will double present capacity of the company to produce stainless and high alloy steel. Construction will be designed for the addition of a second furnace for future expansion.

v v v

A 20,000 sq-ft plant addition has been completed by Surface Combustion Corp. to house the heat treat furnace and gas generator assembly department. Facilities for the new structure include railroad and truck loading and a 15-ton overhead crane.

v v v

In keeping with recent expansion plans, Stanat Mfg. Co., Inc. has begun construction of a modern plant on Brush Hollow Rd., Westbury, L.I., N.Y. The building, scheduled for completion this year, will include manufacturing areas as well as engineering and administrative offices.

v v v

HeaTube Corp., manufacturers of electric heating elements and devices has been expanded to a two-plant operation. This development involved complete retooling for filling and reduction operations in fabrication of tubular electrical heaters.

combined efforts

Tool steel operations of Vulcan Crucible Steel Div. and Henry Disston Div. have been combined, and Vulcan will now be the exclusive producer and seller of tool steels within the H. K. Porter Co., Inc. Steel Distributers, Inc., formerly distributors for the Henry Disston Div., will be the distributor for Vulcan tool steel in eastern Pennsylvania, southern New Jersey and Delaware.

v v v

Effective September 1, Brown & Sharpe Mfg. Co. and Nelco Tool Co., Inc. combined their sales operations to provide faster, convenient and more diversified service through Brown & Sharpe-Nelco distributors, which now form a nation-wide carbide tooling service.

New "Series 333" Drills for Drilling Cast Iron!

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INDICATE A-10-203-1

DICTIONARY OF METALLOGRAPHY—*by R. T. Rolfe. Published by the Chemical Publishing Co., Inc., 212 5th Ave., New York 10, N. Y. Price $5.75. 287 pages.*

The book is not only a compilation of definitions, but is like an encyclopedia, even listing references where deemed important. Balance of theory and practice, extreme accuracy, up-to-date coverage, lucid explanations and ample cross referencing are among the many features. Included also are pertinent terms from collateral sciences.

ENGINEERING METALLURGY—*by L. F. Mondolfo and Otto Zmeskal. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. Price $7.50. 403 pages.*

This book is written as a college text for the teaching of metallurgy to engineers whose primary interests do not reside in the metallurgical field. Detailed descriptions of methods and operations are given, but the emphasis has been on the theoretical reasons behind the operations.

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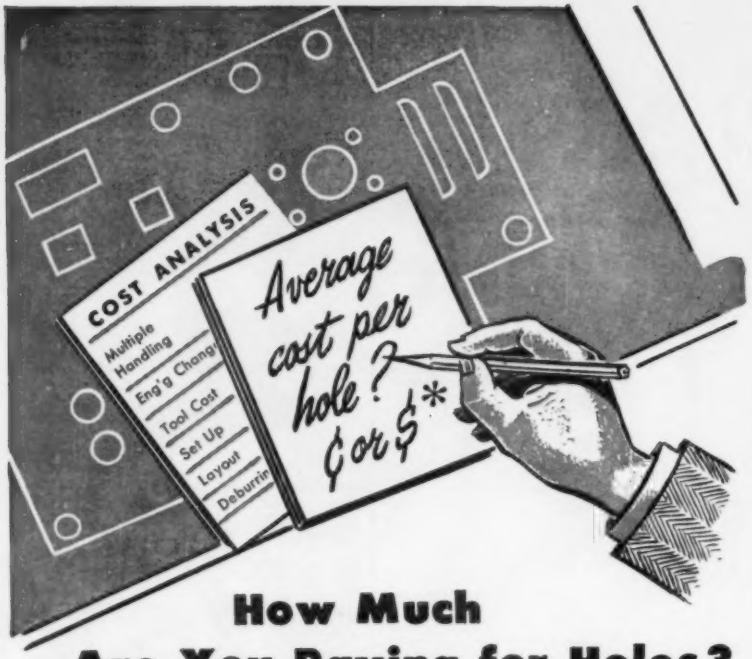

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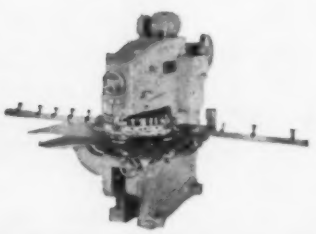

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HYDRAULIC AND PNEUMATIC OPERATION OF MACHINES—*by H. C. Town. Published by Philosophical Library, Inc., 15 E. 40th St., New York 16, N. Y. Printed in Great Britain. Price $7.50. 192 pages.*

An essentially practical book which for the first time deals with the latest developments in both hydraulic and pneumatic power and their applications to modern engineering production. In addition, it deals with the use of pneumatic power which may be corelated or have similar applications to that of hydraulic transmission.

Much of the information in these fields has heretofore been somewhat scattered and inaccessible and it is felt that this book brings much of the data together from specialist sources.

A valuable aid to engineers, students and designers in modern industry.

INTRODUCTION TO PLASTICITY—*by Aris Phillips. Published by The Roland Press Co., 15 E. 26th St., New York 10, N. Y. Price $7. 229 pages.*

This is an introductory text on the subject of metal plasticity, written from the point of view of the stress analyst. It is written for the advanced undergraduate and graduate student of engineering and for the practicing engineer. The aim throughout is to prepare the student for advanced work by enabling him to formulate and solve the more elementary problems.

The treatment of the subject is analytic in method and logical in arrangement, the material in each chapter forming the basis for an understanding of the following chapter.

FUNDAMENTALS OF PRESS TOOL DESIGN—*by W. F. Walker. Published by Philosophical Library, Inc., 15 E. 40th St., New York 16, N. Y. Printed in Great Britain. Price $4.75. 152 pages.*

The use of press tools has done much to meet the demands of mass production. The progress of this method of production and its potentialities has led to greater interest and has resulted in the use of more complicated tools, of more powerful presses, and the production of more exacting tool steels.

This book is directed toward identifying and explaining the fundamental requirements which must be known and understood for each different press operation, so that tools efficient and economic in operation can be designed.

The text is amplified by the addition of over 160 line drawings, ten tables and numerous formulas. Contents of this book will prove invaluable to all those actively engaged in the press tool industry.

HANDBOOK OF INDUSTRIAL STATISTICS—*by Albert H. Bowker and Gerald J. Lieberman. Published by Prentice-Hall, Inc., 70 Fifth Ave., New York 11, N. Y. Price $5. 207 pages.*

This book is a reprint of the section on industrial statistics in the Handbook of Industrial Engineering and Management, edited by W. G. Ireson and E. L. Grant. It has been published separately to serve as a useful and convenient tool for engineers. It explains in detail the most commonly used statistical techniques and provides adequate tables for use in applying each one.

In beginning each section of the book, the authors concisely explain the practical value of the information it contains.

Presenting statistics as a science for making decisions, this book is of special value to engineers and physical scientists.

THEORY AND PRACTICE OF LUBRICATION FOR ENGINEERS—*by Dudley D. Fuller. Published by John Wiley & Sons, Inc., 440 4th Ave., New York 16, N. Y. Price $10.50. 446 pages.*

This book was written with several objectives in mind. The first of these is to present the theory of lubrication to the engineer in the most understandable and usable form. Another is to systematize and generalize the basic concepts that arise from the theory of lubrication, so as to permit the development of an organized course of study both for the classroom and for the individual.

Numerous examples are worked out in discussions of problems. Many bearing designs are given, including those for machine tools, turbines, generators, large motors, rolling mills, ball mills and centrifuges.

CASTING KAISER ALUMINUM—*published by Technical Publications Dept., Kaiser Aluminum & Chemical Sales, Inc., 919 North Michigan Blvd., Chicago 11, Ill. Free on company letterhead or $2 for personal libraries. 388 pages.*

This book points out the more advanced methods used in producing sound aluminum castings. In addition, detailed data about aluminum and its alloys are provided for comparative informational purposes. Principal casting methods are discussed at length. Material has been coordinated for practical interpretation and use.

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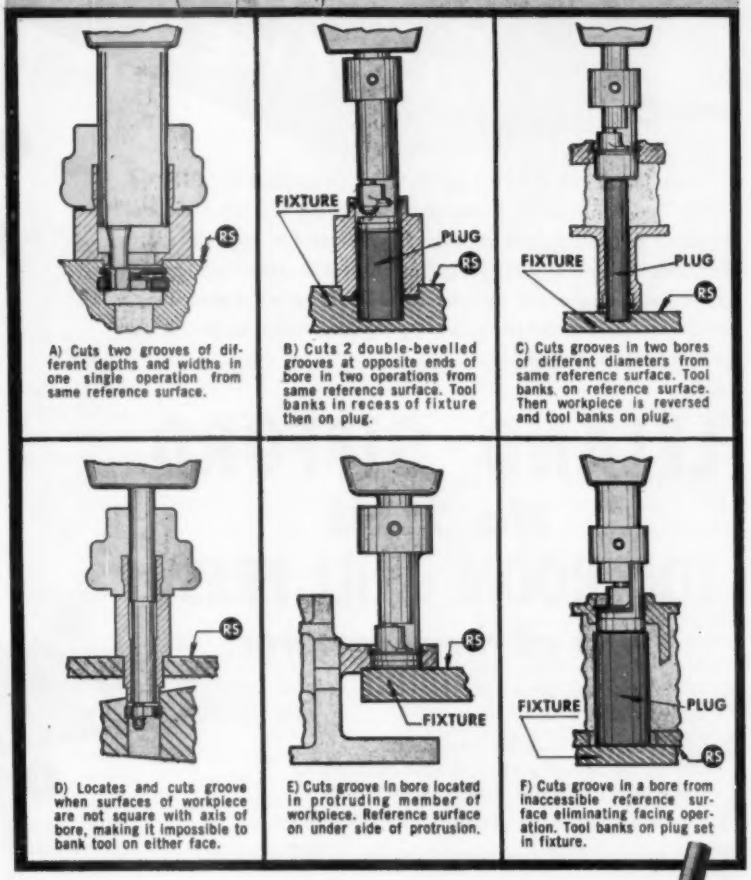

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pushbutton potential *can simplify production mobilization*

Tech Digests

By W. Fay Aller
V. Pres. and Dir. Research Div.
The Sheffield Corp.
Dayton, O.

PAST EXPERIENCE INDICATES the vital importance of buying extra preparedness for national protection. How can this time insurance be secured? It can be bought at surprisingly nominal cost by making broad and progressive use of the stockpiling principle in technology as well as in materials.

The principle is one of pushbutton potential, in effect, constantly storing up energy like a condenser, which would be ready to release peak capacity on split-second demand.

In military production, science and industry are faced with the challenging fact that almost everything stockpiled today may be obsolete tomorrow or a year from now. This rapid rate of progress extends to metallurgy, tools, and methods. The fact must be faced that it is possible to stockpile only a limited number of tools required for a possible pushbutton conflict.

The answer, pushbutton potential, is in its simpliest meaning a standby reserve of versatile automated productive capacity. This may well be the nation's most important secret weapon.

The pushbutton potential suggested would be the most advanced combination of automation and "Autometrology," which is the machine controls, feedback and automatic inspection required for automatic production. Simply, auto infers automatic and metrology infers measurement. This system of automatic manufacture could be placed in limited operation now, ready to go into high production at the touch of a button.

Automatic Plants Needed

The plan suggests development of plants using automatic handling, machining, gaging, controlling, assembling and testing. These plants would be operated at extremely low speed or for short periods to produce necessary limited stockpiles of material. Without additional equipment or trained man power, their production could be increased many fold as might be necessitated by any emergency.

Feed-back controls on "in-process" or "post-process" gaging, *Figs.* 1 and 2, would not only reduce scrap, but allow an operator to handle many machines more efficiently than conventionally. It is now possible to work to closer tolerances automatically than manually, just as it is even now possible to direct missiles by instruments at speeds beyond human capacity. In industry, automation must be simple, easily serviced and dependable, *Figs.* 3 and 4. In defense industry, it must be particularly flexible, so that new tooling can be rapidly and easily installed with a minimum of drastic changes in control and gaging components.

Many consumer industries have already found it possible to achieve greater efficiency and economy by planning automatic processing installations with fixtures, measurement and control sufficiently universal and flexible to accommodate future tooling changes and improvements without drastically overhauling or replacing the entire system.

In high production industries, there is little or no uneconomical stockpiling of parts or end products, because it is unnecessary. Automation has provided readily available pushbutton potential needed to step up output. Both the tools which machine parts and the precision of each piece can be supervised no matter what the production level. This is automation in action in consumer industries—achieving high quality, high precision and desired production rate with minimum man power.

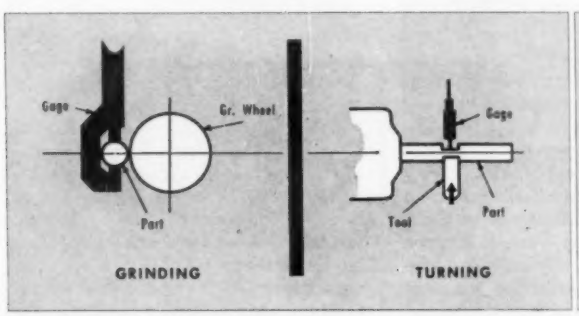

Fig. 1. In-process control prevents faulty parts from being made, by initiating signals for tool correction or replacement before part size is out of control.

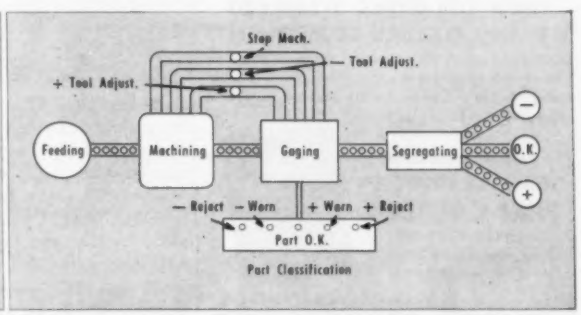

Fig. 2. Post-process control means on the spot inspection and rejection of faulty parts. The gaging station is generally adjacent to machining operation.

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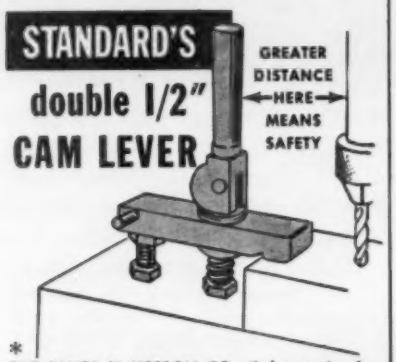
...up to 3,450 lbs. clamping force



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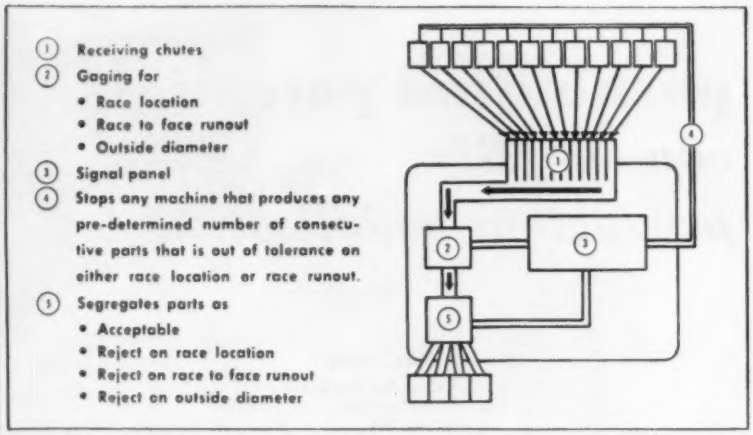
1 Receiving chutes
2 Gaging for
• Race location
• Race to face runout
• Outside diameter
3 Signal panel
4 Stops any machine that produces any pre-determined number of consecutive parts that is out of tolerance on either race location or race runout.
5 Segregates parts as
• Acceptable
• Reject on race location
• Reject on race to face runout
• Reject on outside diameter

Fig. 3. Setup for gaging and controlling 12 grinding machines in production of ball bearing cups.

Equipping America with minimum effective stockpile of "pushbutton potential" involves a small investment. It is less, comparatively, in fact only a fraction of that required for machine tools to power the national defense. How small it would be can be estimated by the relative insignificance of the cost of the machine tools themselves as compared with the cost of weapons and material delivered by them.

Fig. 4. Gaging and segregating machine inspects ball bearing cups from 12 grinding machines at rate of 1600 parts per hour.

Compared with the cost of a single Nike, Talos, Falcon or Matador missile —from initial research and development through production and final testing—the estimated premium for pushbutton potential insurance would be comparatively nominal, indeed. Yet it can be the condenser of productive power that will permit the country not only to turn out better weapons of defense but to meet needs, should the time come, in the volume required.

From a speech given before the Joint Meeting of Industry Advisory Committees, Business and Defense Services Administration, Department of Commerce, Washington, D. C., June, 1956.

▼ ▼ ▼

The Selection of Technical Managers

By A. P. Johnson

Counselor and Teacher
Testing and Guidance Div.
Newark College of Engineering
Newark, N. J.

Technical managers are persons whose value to their companies stems from both their technical know-how and from their managerial skill. The selection of technical managers will become an increasingly critical problem during the next 10 years. In an advertisement directed toward engineering students some months ago the General Electric Company stated that GE leadership jobs were expected to double in the next decade. Within the last year a Westinghouse representative has said that they are having a hard time finding the right men to fill all of the technical management positions now opening as a result of the growth of the electrical industry.

From many sources one learns of a number of young technical men who do not wish to make the effort to get ready for or take on additional responsibility. Meanwhile the shortage of engineers and scientists continues.

At the first Engineers' Joint Council General Assembly several speakers pointed out that many engineers in the nuclear energy field who have successfully met extraordinary technical challenges do not understand the economics of industrial use of nuclear energy. Apparently this is largely because all of their work has been directly or indirectly for the U. S. Government on defense material where technical rather than economic feasibility was the principal consideration. To some extent, also, the understanding of the economics of industrial use may, for much the same reason, be limited among those mechani-

cal or other engineers whose experience has been wholly on government projects.

The foregoing leads to the conviction that the problem is not only one of selecting the right men to be technical managers but also one of fostering an interest among engineers in developing, with or without company assistance, any latent management potential they may have. In many companies, only by fostering this interest will there be enough technical managers on hand to make possible even moderately effective selection.

From a paper given at the ASME Semi-Annual Meeting. The American Society of Mechanical Engineers, 29 West 39th St., New York 18, N. Y.

▼ ▼ ▼

New Developments in Metal Cutting

By D. J. Millar, President
Greenfield Tap and Die Corp.
Greenfield, Mass.

Recent developments in metal cutting tools can be divided into three parts: new materials, new tool designs, and new manufacturing methods. Several new materials have attained prominent notice in the last two years.

One development has been the introduction of improved grades of carbides for cutting steels. The improved properties of these carbides have been attained by changes in manufacturing methods that cause a coarser grain structure plus certain other differences in crystal formation. Percentages of elements have not been materially altered, but the changes have resulted in a tougher, more wear resistant tool material increasing tool performance significantly.

High speed steels having higher carbon and vanadium contents are being used to fulfill special requirements. These might be cutting of tougher materials or demand for longer tool life between grinds as required for automation.

Use of sulphur additions in high speed steels has improved machinability. Companies using the high speed steels with higher sulphur content claim savings in machining costs because the tools used in manufacturing operations have longer life and decrease machining time.

Ceramic tools have had a spectacular impact. Comments indicate they are extremely brittle, very hard, require special tool holders, extreme machine rigidity and power. There is a great deal to learn about proper application in manufacturing operations.

Ceramics are made of abundant materials, which is desirable from a military viewpoint. This development has been influenced also by the need of cutting product materials which are harder and more difficult to machine. These materials will probably supplement available tool materials rather than replace any one group. New cutting tool designs are constantly introduced for special application such as machining titanium or high temperature alloys.

New tool design should include clamp or throw-away type carbide tools. Refinements in this design have resulted in greatly increased application during the last few years. These tools have the important advantage over the brazed type in that each bit may have from

Special tap application required these large size tools which are typical of unusual requirements.

Torque testing of tools is one of the many activities carried on in the physical laboratory, Research and Testing Division.

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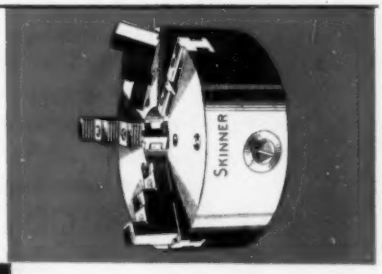

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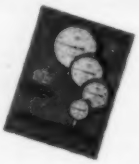

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3 to 8 cutting edges depending on the design. Tools can be changed rapidly and it is cheaper to throw away the worn bit rather than regrind it. It is estimated that this type of tooling accounts for about 30 percent of the total at the present time and it is possible this may double.

Cutting tool manufacturers must maintain extensive research facilities to keep abreast of new developments. In this company, it means complete inspection measuring equipment for all types of tools manufactured, machines of various sizes to test their performance, equipment to measure tapping torques, and other variables, etc. A combination of engineering and research skills and equipment permits successful solution for supplying properly designed tools for varied special applications.

Such requests are particularly important in relationship to automation. This stresses the number of pieces a tool produces per grind since down time of such equipment must be held to an absolute minimum.

Improved manufacturing methods in the cutting tool industry include special purpose grinding machines that have resulted in better tools and increased production.

The job of the cutting tool industry in a national emergency is to keep producing tools needed for the basic economy and to supply armament programs quickly and adequately. This second requirement means that it is necessary to keep abreast of new materials and new requirements, be prepared to train personnel needed, study requirements of lead time, try to anticipate military requirements, and keep the government advised of what and how much the industry can produce in the way of tools.

From a report given before the Joint Meeting of Advisory Committees, Washington, D. C., June, 1956.

▼ ▼ ▼

Organized Production Planning

Panel Discussion
Panel Leader: G. E. Fouch

General Manager
Evendale Operating Dept.
General Electric Co.

A sound foundation in organization of production planning is necessary to timely product availability. The basic steps in the management process to accomplish this are as follows:

The objective is the most important step in the management process, as it is the reason for the existence of any organization. The purpose for which the organization was established must be the yardstick of measurement.

The operating program is the next requirement. It must be established to meet the objective. The plan must be reasonable in its requirements and consistent with resources available. The program sets forth the important benchmarks, time-phased as to the kind and quantity of accomplishment for each of the key organizational components. Coordination in use of resources and balanced accomplishment can be assisted materially by each major segment of the organization programming its course of action in accordance with a common master program.

Once the operating program has been translated into action, it becomes necessary to provide a more or less mechanical procedure for the periodic receipt of performance reports to provide the coordinating authority with a continuing service of factual intelligence. The frequency of reporting should be adequate to prevent a wide deviation from program to occur before detection and yet not so frequent as to minimize changes and place an undue reporting burden on operating units. The report must be timely. An indication of an approaching problem area today is much more valuable than a detailed blueprint of the situation eight weeks later.

FOR AVAILABILITY OF COMPLETE PAPERS WRITE THE HEADQUARTERS OFFICE OF THE SOCIETY NOTED AT THE END OF EACH ABSTRACT.

Periodic analysis of progress is essential to add the dynamic life of management coordination to the process. It is the continuous, regular comparison, analysis and presentation of actual performance or status with the current program and objective. From this process, the need for and direction of new action is determined. Recommendations for new action should be designed to rectify causes rather than effects. Effort expended on effects merely increases workload. The elimination of causes provides a more permanent solution.

This fourth step in the management process is the functional area wherein the manager, exercising his decision authority, is of greatest potential benefit to his organization in the efficient and economic attainment of the objective.

From a panel discussion held at the 1956 National Aeronautic Meeting of the Society of Automotive Engineers, 29 W. 39th St., New York 18, N. Y.

Economics of Automation

By Charles H. Welling and George H. Woodard, Partners

Welling & Woodard
Industrial Consultants
New York, N. Y.

Automation is largely a result of clearly identifiable economic causes. It is an engineering response to economic pressures.

One of these is full employment. The American people have no particular ideas as to what is meant by this term, but the principle is here to stay. Second, the American people believe in an annual increase in the hourly rate of wages, with attending fringe benefits, regardless of productivity. The feeling is that the wage increase should come first and it will inspire productivity. This is the reverse of the thinking 30 years ago.

Third, the American people believe these twin benefits can be accomplished through government action. Government will be responsible to see to it that these benefits exist.

These things represent the background on the subject of employment and wages: mass production of consumer goods to satisfy greater purchasing power; demand for shorter working hours and more leisure time to use the newly available flood of consumer goods. Every increase in the hourly wages is providing the opportunity and

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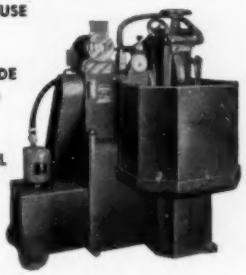

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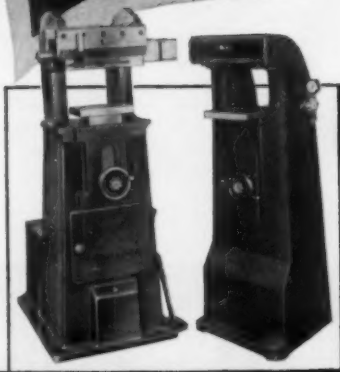

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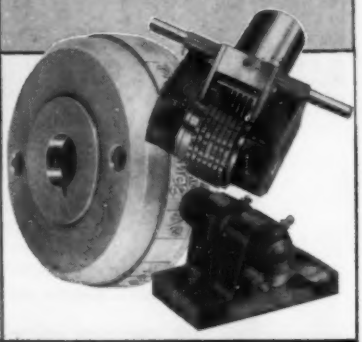

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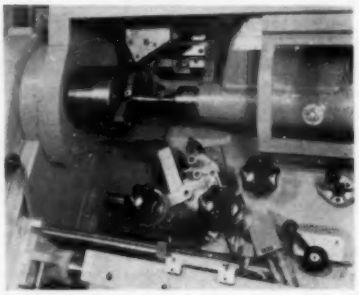
incentive for a new special business machine or more automatic production lines.

What is the impact of these changes upon business economics? First of all, manufacturing industry will be increasingly dominated by automation, high production and mass distribution. Engineers are becoming scarcer, meaning that more are needed. Upgrading of workers is taking place. The national pattern of wages in productive industry will be set by large corporations with highly mechanized production systems. Employers selling to narrower markets and lacking opportunities for increasing their productivities must follow closely the wage patterns set by large corporations. The man supervising or controlling a fully automatic machine, or



Setup on New Britain copying lathe is typical of tracer type operation.

series in a system, is more productive per unit of wage cost than as a skilled operator a few years ago. Productivity per dollar of wage cost has increased.

On the other hand, the production worker whose productivity is related to his skill with a single machine, or processing step, is less productive in terms of dollar of wage cost. The product of such methods of manufacture must be offered at constantly increasing prices.

A recent development relating to these changes has been the trend of American manufacturers to seek sources of production abroad in areas of lower wage costs, where high levels of individual mechanical skill are involved. Manufacturers are becoming increasingly oriented toward the maintenance and expansion of their markets as a dominant aspect of their businesses. As a result several points of domestic manufacture are often regarded as necessary for market position. The next step to a Canadian plant has been an easy transition. Further steps to European, South American and Western Pacific points are becoming simpler than would have been considered a few years ago.

Thus the non-mass producing manufacturer is faced with two alternatives:

First, he must go abroad for skilled handwork at lower wage costs, or second he must learn to apply more automation to lower levels of production.

Fortunately, it is not necessary to start with a completely automatic machine or system in order to reap some of the largest economic benefits from its use.

A process may be mechanized if, as minimum elements, the machine is provided with simplest form of programming and information storage device: the mechanical template or cam. An example of this is the automatic, tracer type lathe. These are equipped for completely automatic work cycle. Some have been further refined by addition of automatic loading and unloading devices. Many are equipped with multiple tool slides.

While most of these machines employ precut metal template with little additional development, their hydraulic control systems might be programmed instead from punched paper tape, magnetic tape or other information storage medium.

Universal drilling machine provides for automatic operation, developed by Hartford Special Machinery Co.

A fascinating thing about such machines is the fact that they are being used in both mass production and small batch production industries. It is said to be entirely economical for runs in the order of 20 to 100 pieces. A wide variety of automatic machines based on the same philosophy of flexible automation are being developed. Within a few years there will be a wide group of such equipment from which the middle sized batch producer can make his selection.

Such tools of the automation trade possess two very important features: they provide greater accuracy than possible previously and more important they possess a greater range of flexibility. It may take a skilled setup man several hours or days to change a com-

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plex system of mechanical cams and linkages or to alter ratios of a gear train. A less skilled operator can, in a few minutes dial the controls on an electronic or hydraulic programming system according to a simple set of numbers on a process sheet. This may be an over-simplification, but illustrates the direction of current development and the meaning of flexible automation.

It is obviously no longer a question of whether middle group of manufacturers can afford such mechanization. It is simply and directly a matter of competitive economics, with already mechanized, mass producing industry setting standards of worker income, productivity and low unit costs.

FOR AVAILABILITY OF COMPLETE PAPERS WRITE THE HEADQUARTERS OFFICE OF THE SOCIETY NOTED AT THE END OF EACH ABSTRACT.

It is fast becoming possible for the middle section of manufacturing industry to approach equality of costs. In doing so, these companies need not abandon the principle of product diversification which is so essential to future safety.

Front a Joint Address before the American Institute of Industrial Engineers, Cleveland Conference.

▼ ▼ ▼

Liaison Between Manufacturing and Product Engineering

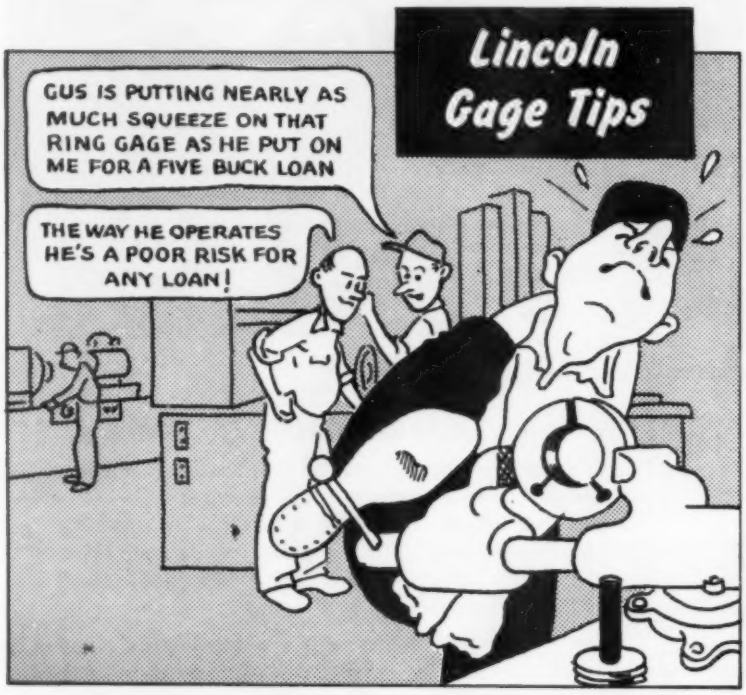
By Godfrey Burrows

Chevrolet-Flint Frame and Stamping Plant
Div. G. M. Corp.
Flint, Mich.

In the automotive industry, product engineering has two major problems. First, the product engineer is concerned with a design that meets the styling requirements. He must produce a design with beauty of line, pleasing contours and symmetry that stimulates pride of possession. With these things he must also design into the product, quality functional characteristics.

With these requirements comes the relation to the manufacturing process engineer. These concepts of design must be worked out so that all components are designed in a manner to enable the process engineer to do his job efficiently. This is to produce components with methods that will result in decreased manufacturing costs, material savings and simplicity of tooling, which results in an uninterrupted production continuity. Because of ever mounting cost of facilities, such as machinery and tooling, it is of vital importance that the design engineer collaborate closely with the production engineer. This close collaboration is necessary to insure sufficient flexibility and adaptability in the design of machinery and tooling to accommodate known or anticipated design changes.

Procurement of expensive facilities which lack required adaptability to future design changes, may result in obsolescence of facilities representing substantial investment with little or no accrued amortization. Product design is not just a relationship to the processing engineering. It is, and should be, interwoven into its relationship. Because of this relationship, the product designer has fulfilled his obligation to management only when he is sure that the manufacturing processer has not been confronted with unavoidable major problems which good product design would have eliminated. Further, in all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planning, primary consideration must be given to safety of employees and protection of property from all hazards.

The basic concept that both the product designer and the manufacturing process engineer are equally dependent upon each other is of vital importance for survival of an organization in this ever increasing competitive era.

Abstracted from "New Techniques of Automobile Frame Manufacture," SAE paper No. 771, presented at the Atlantic City summer meeting, Society of Automotive Engineers, 29 W. 39th St., New York 18, N. Y.

▼ ▼ ▼

Thermal Cutting of Aluminum, Stainless Steels and High Nickel Alloys

By E. H. Roper

Air Reduction Sales Co.
New York 17, N. Y.

Ease with which even the heaviest section of ferrous materials can be cut by means of the oxyacetylene torch has long been a source of envy to the fabricator working in materials that must be cut and shaped by mechanical means, such as shearing, sawing, nibbling, routing and the like. As a result, it is only natural that there should be efforts to use the heat of the arc for cutting purposes. Some of these methods as, for example, carbon arc cutting, are quite old.

This paper describes development of techniques using basically standard arc welding apparatus for both the manual and machine cutting of aluminum, stainless steels, Monel, Inconel and nickel plate. Data presented cover the cutting of materials up to 1¼ inches thick. The criteria for the production of quality cut surfaces using a consumable electrode are discussed. In the course of this work high speed motion pictures were made, which shed much light on the behavior of the arc in the kerf under the conditions of high current density that seem needed to produce the best results.

From a paper given at the annual meeting of the American Welding Society, 33 W. 39th St., New York 18, N. Y.

▼ ▼ ▼

FOR AVAILABILITY OF COMPLETE PAPERS WRITE THE HEADQUARTERS OFFICE OF THE SOCIETY NOTED AT THE END OF EACH ABSTRACT.

How Canada is Attacking Air Pollution

By E. A. Allen, Head

Department of Mechanical Engineering
University of Toronto
Toronto, Canada

This problem of air pollution has increased in seriousness and complexity until it affects whole communities and extends beyond the scope of purely short-term remedies or legislation. Lack of agreement on definitions and techniques of measurement and control led to an unsatisfactory situation that could only be rectified by agreement on an international basis. Action to achieve this must be taken before too late.

The type of land and meteorology of the country surrounding an industrial area, as well as heights of industrial stacks, determine what air pollutants reach ground level in business and residential districts. Moreover, a heavy layer of smoke haze at the ground, particularly if thickened by fog into a smog, resists penetration of sunlight, thus preventing heating of cold air in a valley which would make it rise. Rapidly increasing use of mechanical transport adds to the problem.

Gasoline engines on rich mixture give off large volumes of carbon monoxide, a dangerous gas in sufficient concentrations. Harmful pollution from this source, however, seldom reaches dangerous levels. The problem of contamination from locomotives and steamships is that of jurisdiction.

Perhaps most local air pollution con-

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trol procedures have been built around existing organizations originally designed for handling smoke abatement.

The following principles are advocated which may be observed in adopting a policy:

1. Complete elimination of pollution is is not economically attainable.
2. Legislation must be enforceable and have community support.
3. Enforcement policy must be one of continual adjustment and education.
4. Except in cases of definite hazard to health or safety, plants must not be closed.
5. The program must be long-range.

Results from such a program must not be expected too soon. Each community poses a new and different problem which can be solved by arduous effort.

From a paper given at the 70th Annual Meeting of The Engineering Institute of Canada, 2050 Mansfield St., Montreal 2, Quebec.

▼ ▼ ▼

Remote Control Automation

By Mervin J. Kelly
President

Bell Telephone Laboratories
New York, N. Y.

Machines some day will talk to machines in the same fashion that people now discourse by telephone. When automation, now in its pioneering days, attains full development during the next few decades, it will be possible to interconnect over the nation's communications circuits widely separated automation systems.

Then by means of an electronically transmitted digital language, perfected at Bell Telephone Laboratories, automation systems of commerce, business, and industry can be integrated and controlled from one source. It is where human control of machines is taken over by electronic systems, that mechanization evolves into automation.

Nor need Americans fear the influx of automation. The change from mechanization to automation will proceed by a succession of steps, which will allow for adjustment and accommodation as it proceeds. Automation will be beneficial economically and socially. It is a growing economic and social force whose significance can well be larger than that of mechanization.

From a paper, "The Call of Engineering and Science," given at the University of Cincinnati, 50th Anniversary Observance, April, 1956.

New Developments in Machine Tools

By Ralph J. Kraut, President
Giddings & Lewis Machine Tool Co.
Fond du Lac, Wis.

More than 400 types of machines are produced by the machine tool industry in both metal cutting and metal forming types. Builders are constantly improving their machines; sometimes improvements are minor, sometimes involve fundamental redesign with completely new patterns and tooling. This process of improvement has not only come with a rush in the last few years, but concerns practically every type of machine tool made in the country. Changes have resulted in greater per man hour, greater accuracy and greater safety for the operator. Briefly, the outline of what has been accomplished on a few machines is as follows:

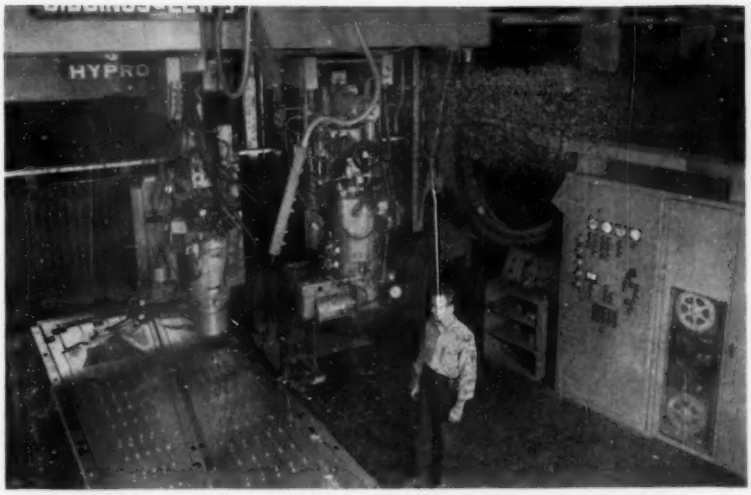
1. More effective use of tracer controls.
2. Provision for constant surface speed as the diameter of work changes.
3. Control by recorded information—cards, film or tape.
4. Wider speed ranges for effective use of new cutting tools.
5. Multicut cycle, ie. a complete cycle of successive cuts in one setting to reduce down time.
6. Automatic loading and unloading.
7. Automatic controls, more attachments, air feeds, wider feed ranges, finer gradations in feed, better electrical equipment and higher horsepower.
8. Greater sustained accuracy.

The old style spinning lathe has now been basically redesigned and can give economical production of many conical or cylindrical parts such as required for jet engines and guided missiles. This is truly chipless machining. Center drive lathes have been developed to face both sides of jet engine compressor and turbine discs.

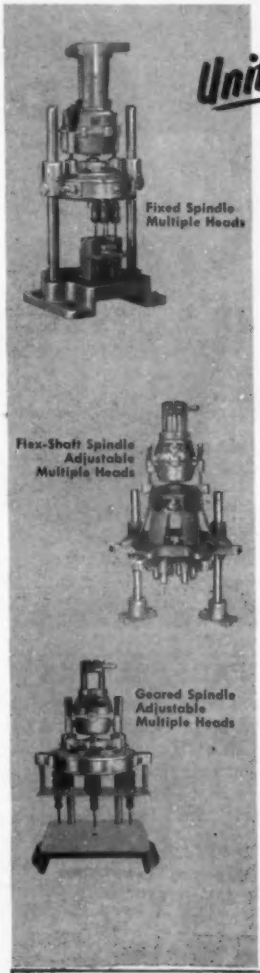
In knee and column type milling machines, there have been similar changes as listed above. On bed type machines, the elimination of backlash permits climb milling with feed up to 150 ipm and infinitely variable.

Planer millers have been greatly improved in metal removal capacity along with greater accuracies. These machines can remove up to 700 and 800 cubic inches of steel per minute while maintaining accuracies of 0.001 inch.

Skinmilling machines have been developed to operate from numerical data



Machining empennage skins on a tape-controlled milling machine.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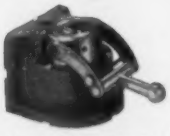

Vertical-horizontal collet fixture

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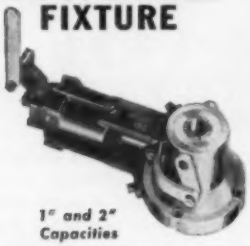

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Manual or mechanical control is optional on the "Air-O." The cam or chain can be readily connected. Solenoid operation is possible for the valve control. Parts are interchangeable. Far out-speeds hand operation.

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1" and 2" Capacities

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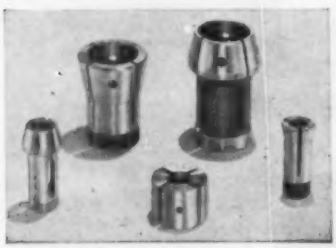

COLLETS, PADS, BLANKS

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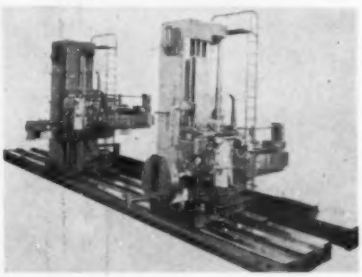
recorded on magnetic tape. Aircraft fighter skins are being produced by this process. The future holds great promise for further development of this system. These examples are typical of machine tools throughout the industry.

Developments in the multistation or transfer machines are so dramatic they hardly need to be recounted. A production line can include a great variety of machining and inspection processes and can be altered to meet product changes. Assembly machines, while not technically machine tools, are likely to show great improvements leading to much wider use. They may well serve to reduce failure in guided missiles due to faulty assembly.

Single and multiple-spindle chucking machines have also undergone substantial redesign and can be built for much larger pieces than formerly. Transfer type chucking machines can play a large part in reducing costs in a defense program. There have been many improvements in metal forming machine tools. Electromagnetic clutches are being used instead of mechanical friction clutches, overload devices control breakage, and other devices afford greater safety to the operator. Automation has been applied in metal forming with automatic loading and unloading and better timing.

In summary, there has been substantial improvement throughout the industry. Changes have increased output and accuracy on the standard general purpose machines as well as those that are special. Use of these new machine tools can substantially reduce the man hours required for defense in event of war and relieve what would otherwise be a serious manpower shortage.



Two electronic tracer control machines mounted on a common runway.

Such machines, being larger, more powerful and more productive, cannot be hastily produced. They must be built now in time of peace if they are to be available in time of war.

From a presentation before the Joint Meeting of Industry Advisory Committees, Business and Defense Services Administration, Department of Commerce, Washington, D. C., June 6, 1956.

When the SQUEEZE is on - -

do the job on a
POTTER & JOHNSTON AUTOMATIC
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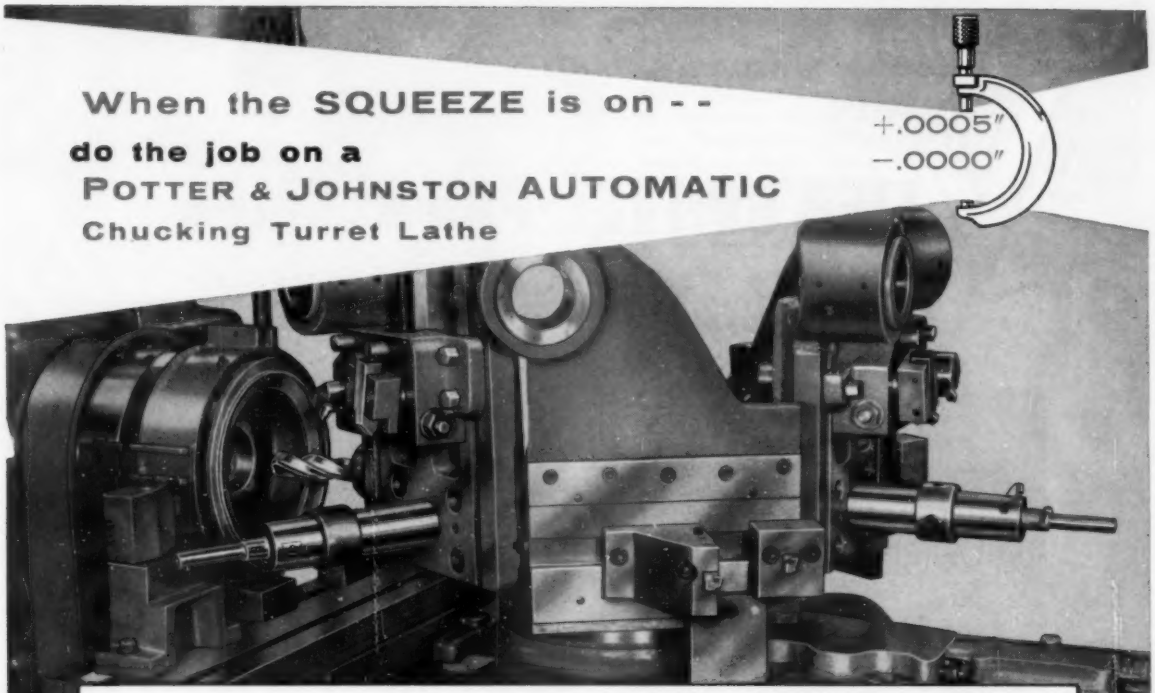

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15 separate close-tolerance cuts including one diameter held to

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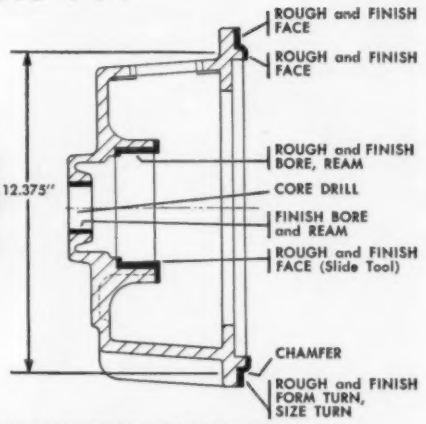


In just 4.31 minutes on a
P&J 5-DELX AUTOMATIX with P&J-ENGINEERED TOOLING

More and more jobs are calling for really close tolerances and fine finishes *plus* far faster production rates. Yes – today's higher standards mean the squeeze is on most of the time; these days you're expected to handle, as routine, jobs that were considered "specials" only a couple of years ago. There's just one way to beat the squeeze . . . profitably! Re-equip with Potter & Johnston Automatics that have the extra speed, power rigidity and versatility it takes to produce faster, more accurately and more economically. And team the machine with P&J-Engineered Tooling that takes full advantage of combined cuts and faster-biting carbide tools to reduce machining time to a minimum.

Write for literature or phone the Pratt & Whitney Office near you, and ask a Direct-Factory Representative to call and discuss your requirements. Potter & Johnston Company, Pawtucket, Rhode Island (Subsidiary of Pratt & Whitney Company, Inc.)

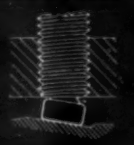
POTTER & JOHNSTON

Precision Production Tooling for More Than Fifty Years
AUTOMATIC CHUCKING TURRET LATHES

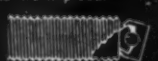
LIER SWIVEL-PAD® CLAMPS

Now Available in 2 Types!

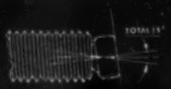
Both types have these outstanding features!



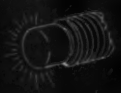
- Screw torque absorbed by pad—not the work piece.



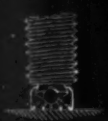
- Unique ball-joint construction provides extremely smooth angle adjustment and rotation of pad.



- Pad swivels 7½° each side of center line in all directions.



- Large flat pad area assures tighter clamping.

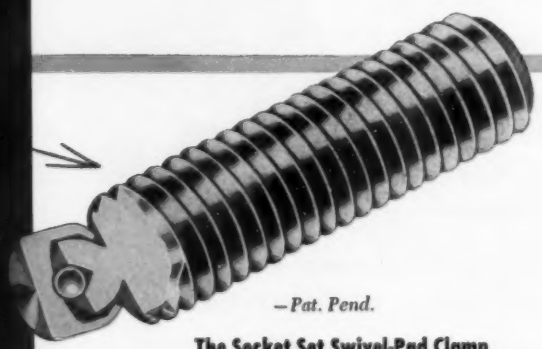


- Conical seat distributes clamping pressure uniformly.
- Eliminates costly, custom-made swivel pads.
- Du-Lite finish for rust proofing.
- Made from heat-treated, alloy steel to last for years.

—*Pat. Pend.*

The new Knurled Head Swivel-Pad Clamp

Use when finger-type clamping is sufficient. Wide knurled-head gives good gripping; assures fast screw run-in. Available in 4 different screw diameters; 1½" and 2" screw lengths.



—*Pat. Pend.*

The Socket Set Swivel-Pad Clamp

Use wherever maximum rigidity is necessary, or where space is limited. Available in 7 screw diameters; various lengths.

Write for free 1956 Vlier catalog.

Other Vlier products

Spring Plungers

Spring Stops

Toggle Pads

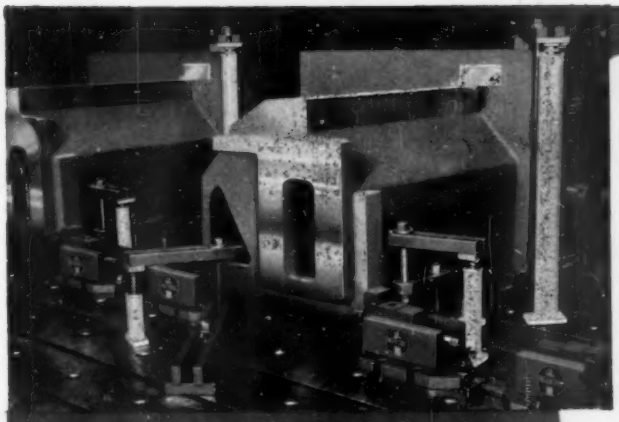
Fixture Keys

Torque Thumb Screws

VLIER ENGINEERING INCORPORATED

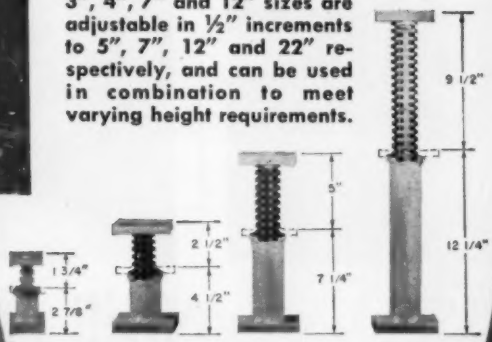
8900 Santa Monica Blvd., Los Angeles 46, California

Distributors located in major U.S. and Canadian industrial areas.



INGERSOLL Setup Aids

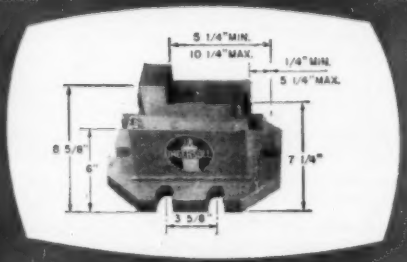
Ingersoll Clamp Posts are used with hold-down clamps to keep work rigidly in position. Easy to handle, they are raised by simply lifting and turning the stem. Standard 3", 4", 7" and 12" sizes are adjustable in ½" increments to 5", 7", 12" and 22" respectively, and can be used in combination to meet varying height requirements.



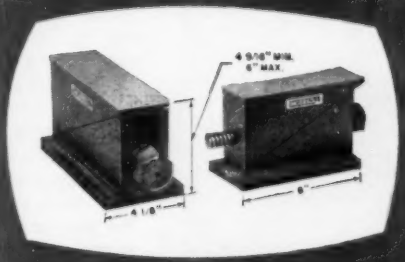
3"-$6.75 4"-$8.50 7"-$12.00 12"-$15.00

Save Time in Milling, Boring, Planing, Drilling

You'll get quick and easy machine setups if you replace makeshift, inefficient equipment with Ingersoll Setup Aids. Developed to help hold and support workpieces during machining operations, they can be used on almost all kinds of machines. Standard sizes shown are immediately available from stock. Information on special sizes will be sent upon request.



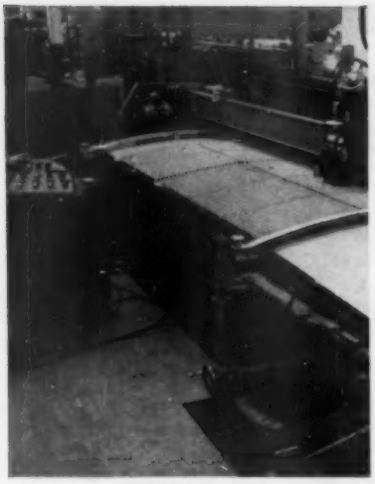
Ingersoll Chuck Jaws — hardened steel jaws mounted in a cast iron base — hold work securely in place during machining. Workpieces can be positioned accurately because surfaces are manufactured to close tolerances. Standard size — $165 each.



Ingersoll Adjustable Parallels provide a firm, stable footing for workpieces. Inclined plane feet made of steel are easily adjustable by means of heat-treated alloy steel screws. Standard size — $65 each.

THE INGERSOLL MILLING MACHINE COMPANY
ROCKFORD, ILLINOIS, U. S. A.

BUILDERS OF SPECIAL DESIGN MILLING & BORING MACHINES
ORIGINATORS OF SHEAR CLEAR CUTTERS



Automatic Skin Drilling Machine

To replace costly, slow hand methods, Grumman Aircraft Corporation designed and fabricated the "skin drilling machine" shown here.

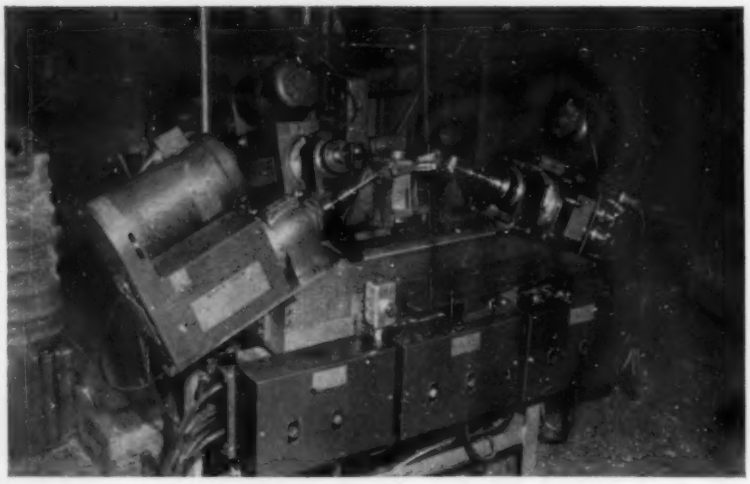
The production requirement was—9000 holes in aircraft skin assemblies consisting of aluminum corrugated section and skin. Formerly, all holes were predrilled by hand in the corrugations and then transfer drilled into the skin. Now, hand work is reduced to tack riveting skin and corrugation and for a few inaccessible areas.

Operation

This new machine clamps the workpiece to prevent burring, drills #40 holes usually ⅝" apart and indexes automatically to next position. A chain and sprocket 1 H.P. drive, regulated by template and photo-electric controls, moves the drill head and lower ram assembly along parallel rails from hole to hole. The workpiece remains stationary. Row on row indexing is done by an air driven gear and rack assembly. 50 to 55 holes per minute, or about four hours per assembly, are now achieved.

Savings

In addition to the remarkably high time savings of 7½ hours per workpiece, other benefits include reduced jig time and number of jigs, extended drill life and the elimination of operator strain. The drill head used is a Dumore 20-011, self-contained with a rotary vane compressor. This is but one of the many automatic drill units made by Dumore for automation purposes. For complete information, write The Dumore Company, 1310 Seventeenth Street, Racine, Wisconsin.



Drill and Tap Automatically with this 2-in-1 Tool

the New DUMORE Series 28

"DRILL-N-TAP" UNIT

Saves Set-Up, Fixture and Service Costs

One of the world's largest farm implement makers, Massey-Harris-Ferguson, uses three new Dumore "Drill-N-Tap" Units to cut costs and increase production on power take-off housings. These units *automatically drill and tap* three holes in two sizes of housings without changing position on the same set-up. A 1"-thick steel plate is placed under the smaller housings for aligning to proper position. Here, the drilling and tapping are done on the same fixture. Drill bushings are simply removed when tapping. *Tap fits into chuck—no extra tapping head is required!*

The Dumore "Drill-N-Tap" Unit is a *driller* and a *tapper* — all in the same automatic machine. Two tools in one — at the cost of only one!

It drills or taps without attachments — no long overhang, or expensive clutches to wear out. Self-reversing motor, electrically controlled, withdraws tap by reversing spindle rotation. You drill or tap *at the flip of a switch!*

Mounts in 3 minutes — anywhere — on job after job for long or short production runs. It doubles the output of ordinary methods with less tool breakage and scrap losses. Simple nose mounting device provides easy installation on less table area. Work mounts close to fixture with little tool travel for faster cycling, less idling time. 10 speeds from 265 to 4900 rpm.

GET A DEMONSTRATION NOW. . . SEE YOUR DISTRIBUTOR, OR WRITE

YOU CAN DO MORE WITH DUMORE DRILL UNITS

DRILLING • TAPPING • BORING • MILLING • FACING • REAMING • CHAMFERING • DEBURRING

DUMORE PRECISION TOOLS

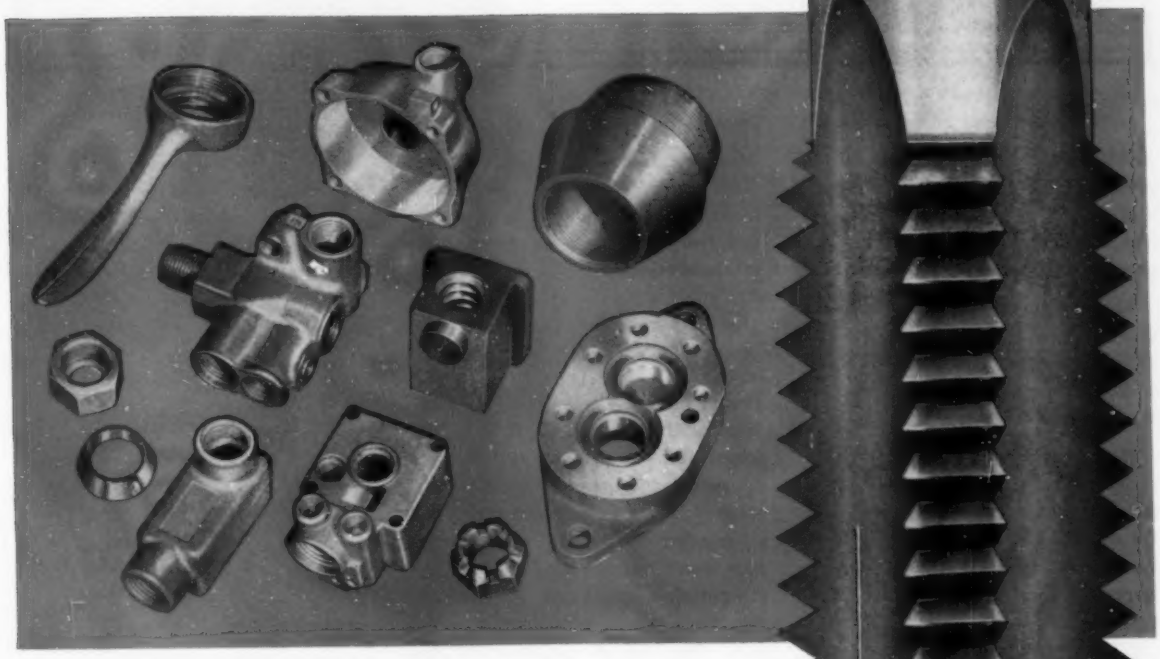
AUTOMATIC DRILL UNITS
TOOL POST AND
HAND GRINDERS

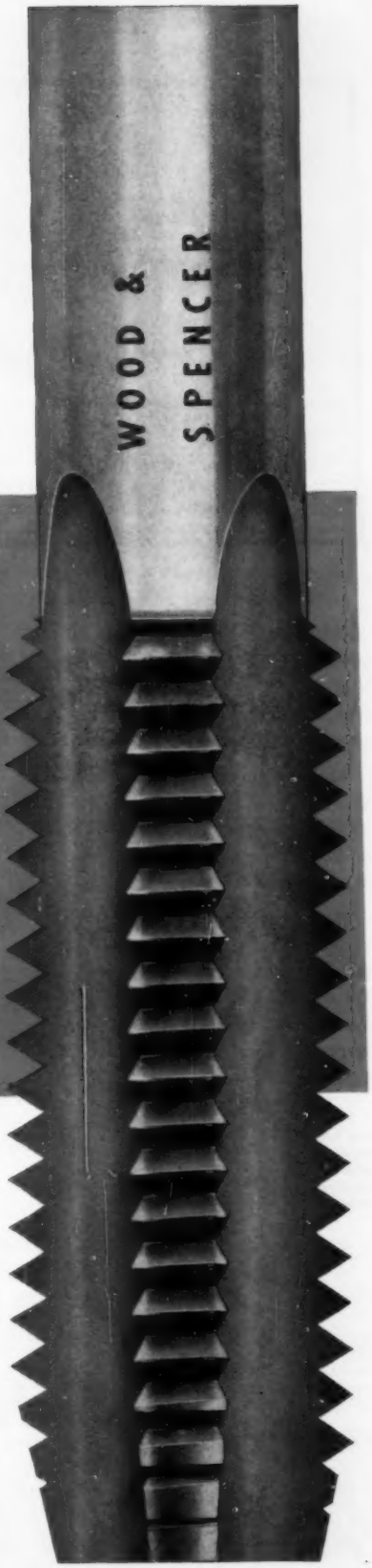
1310 Seventeenth Street, Racine, Wisconsin

Wood & Spencer

TAPS

...Solve Difficult Tapping Problems





On routine jobs, tapping isn't much of a problem today. No matter whose taps you use, they are all about equally precise . . . and do a good threading job.

But, you may run into trouble on especially difficult tapping jobs. In fact, the picture above shows examples of tapping troubles we have solved, and which our customers considered difficult. In practically every case we have recommended practices which have resulted in substantial savings for our customers on their tapping operations.

We have many other examples on file, and we'll be glad to help you solve *your* problem if you'll call us.

Want a free tap guide: Everyone who has one finds this handy wall chart an excellent ready-reference. It tells all standard gage tolerances, class fits and tap tolerances. Write us for one on your business letterhead.

The Wood & Spencer Company • Cleveland 3, Ohio

You can't afford "mistaken identity" on your production line!

It's hard to believe that the wrong metals get into production so often, and even worse, into finished products. Yet the causes of such mistakes are usually very simple.

Errors are made in shipping or metal stocks are mis-identified. Errors occur in processing, too. Accidental mixing of hardened and unhardened parts of similar appearance is common.

No matter how sly their origin, these undetected situations inevitably get out of hand and into cost figures. Tools are damaged; production time is lost. Parts pile up in scrap, or worse, get by inspection and fail in the hands of the customer.

New Brush METAL MONITOR takes the guesswork out of metal identification.

Most plants are surprisingly susceptible to these cases of "mistaken identity" which cost millions of dollars every year. *But now these wastes can be eliminated!*

New Shop Tool Identifies Metals

Brush Electronics offers a new instrument, the Brush METAL MONITOR,* which will detect variations from approved metal specifications at any stage of processing. It works on ferrous or non-ferrous metal, is nondestructive, won't mar finished surfaces. And it's portable, easy to use. Any worker can check any metal anywhere in the shop. The METAL MONITOR prevents losses due to the use of the wrong metals.

How It Works

Metal checks are easy to conduct. The METAL MONITOR probe is held momentarily on a sample of metal known to have the desired structure and composition and the operator obtains an immediate reading. He then holds the probe on the piece to be checked. If the reading is the same, the metal is the same . . . if the reading varies, it's the wrong metal.

Write for this introductory booklet on the new Brush METAL MONITOR now!

To get the complete facts about this fast, accurate instrument, send for your free copy of a brand-new booklet. It describes the Brush METAL MONITOR in detail, explains how it will save money for your company.

*T.M.

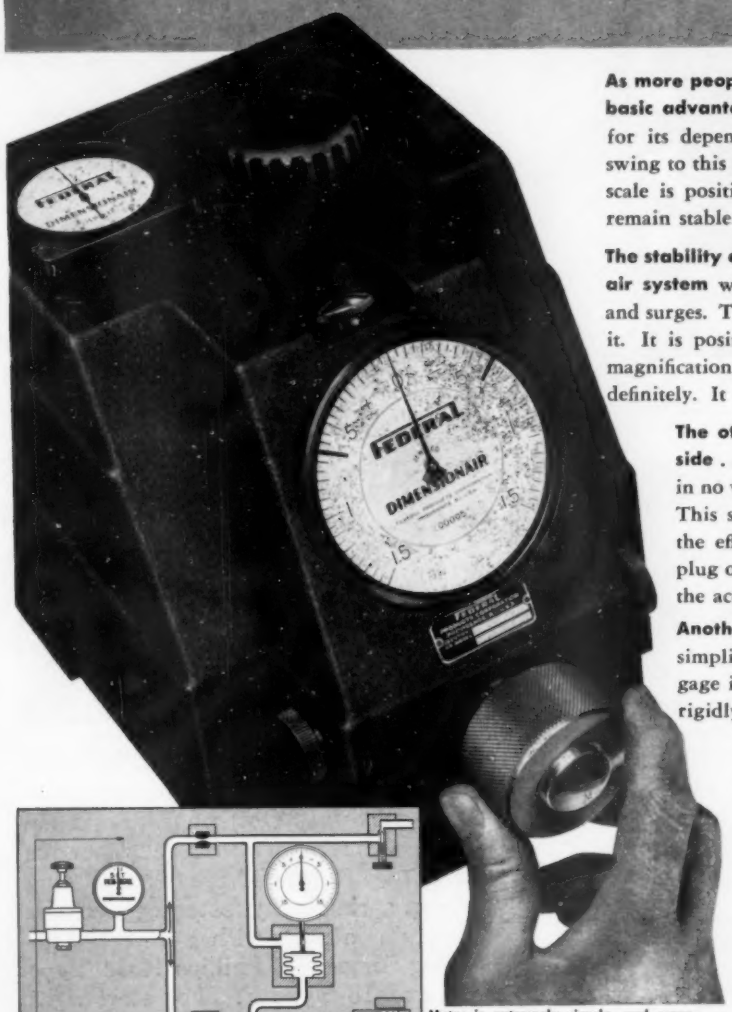
BRUSH ELECTRONICS COMPANY

3504 Perkins Avenue, Cleveland 14, Ohio

BRUSH ELECTRONICS

DIVISION OF CLEVITE CORPORATION

WHY more and more people decide to buy the DIMENSIONAIR



As more people have the opportunity to experience the basic advantages of the Dimensionair their enthusiasm for its dependable accuracy has greatly influenced the swing to this air gage which does not drift. Its graduated scale is positively linear and can be depended upon to remain stable under normal gaging practice.

The stability of the Dimensionair is due to its differential air system which cancels out minor pressure variations and surges. The *measuring side has no zero adjustment* in it. It is positively *fixed* and *cannot change.* The gage magnification remains stable for hours — days . . . indefinitely. It does not drift.

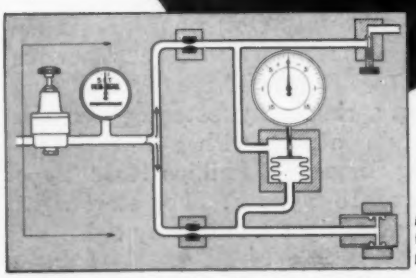
The other side of the system . . . the balancing side . . . has the zero setting adjustment which can in no way affect the stability of the measuring side. This side can also be adjusted to compensate for the effects of temperature changes in the gaging plug or unit. Temperature variations do not affect the accuracy of the Dimensionair system itself.

Another great advantage of this system is the simplicity and positive directness with which the gage is set to zero. Since the measuring system is rigidly fixed, the gage is instantly set to zero without trial and error adjustments.

Let your inexperienced operators try it. You can't appreciate how dependable and foolproof it is until you and others in your department or plant actually try it.

Ask our nearest Branch Office to let you try a Dimensionair.

FEDERAL PRODUCTS CORPORATION
61910 Eddy Street • Providence 1, R. I.



The Dimensionair System is stable because the measuring side is fixed. It cannot drift.

Meter is extremely simple, and wear-free. Pointer movement is fast and positive. No bobbing.

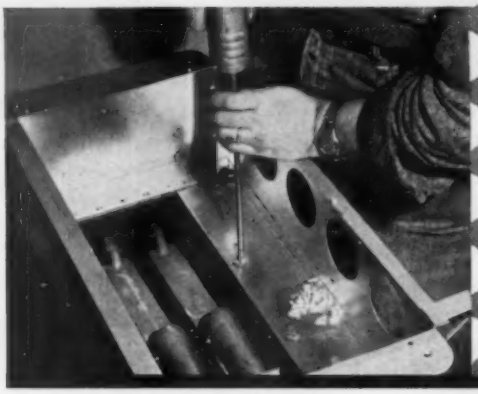
Federal's solution to the cost of gaging:
Impartial Gage Selection
Engineering Follow-Through
Everything In Gages

Ask **FEDERAL** *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automation Gaging

Investigate the assembly savings made possible by P-K® self-tapping screws



Because P-K Type A Self-tapping Screws have clean, deep slots and sharp gimlet points . . . and because they are consistently uniform, Reznor Mfg. Co. enjoys important savings in the assembly of their gas heaters.

To hold the plastic handle halves of their Instant Heat Soldering Irons together, The Lenk Mfg. Co. specifies P-K Type F Self-tapping Screws. No need for a separate tapping operation. Production is increased and costs reduced—thanks to P-K Screws.

Melnor Industries, Inc. (formerly Melnor Metal Products Co.) puts assembly strength into their famous "Swingin' Spray" oscillating lawn sprinkler by fastening zinc and aluminum parts with P-K Self-tapping Screws—7 Phillips Head Type Z and 18 Type F. They start right . . . drive right . . . and stay tight.

PARKER-KALON DIVISION, General American Transportation Corporation
Manufacturers of Self-tapping Screws, Socket Screws, Screwnails, Masonry Nails, Wing Nuts and Thumb Screws

PARKER-KALON® fasteners

Sold Everywhere Through Leading Industrial Distributors
Factory: Clifton, New Jersey—Warehouses: Chicago, Illinois—Los Angeles, California

Miller

FLUID PRESSURE BOOSTERS

BOOST 80 PSI AIR

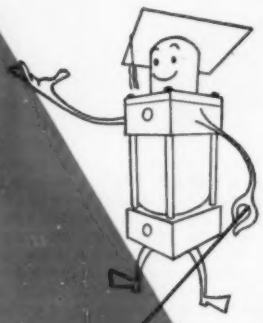
Input Range: 40 to 3000 psi Air or Fluid

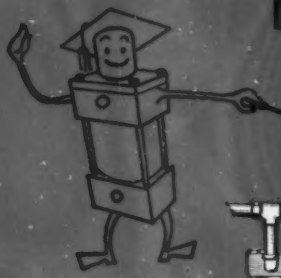
TO 2000 PSI HYDRAULIC PRESSURE

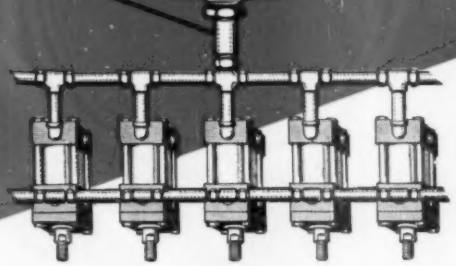
Output Range: 200 to 10,000 psi Fluid

- Save space, weight and investment cost by replacing pump installations in many applications.
- Less costly to install, operate and maintain.
- **Hold Pressure indefinitely** without the motion and heat generation of ordinary pump circuits.
- Provide—at point of cylinder thrust—more efficient power with less weight in less space than direct driven air cylinders
- Save up to 95% of air consumed by direct driven air cylinders
- Operate at speeds of 30 to 450 strokes per minute.

NOTE: In addition to its most complete line of "Custom-Built" Boosters available on normal delivery Miller offers 5" bore, 25 to 1 ratio, boosters for immediate delivery in either 6" or 12" stroke. Write for data and prices.







FULL DETAILS IN MILLER BULLETIN B-200 SENT FREE ON REQUEST
Other Miller products include: Air cylinders, 1½" to 20" Bores, 200 PSI operation; low pressure hydraulic cylinders, 1½" to 6" bores for 500 PSI operation, 8" to 14" bores for 250 PSI; high pressure hydraulic cylinders, 1½" to 12" bores, 2000-3000 PSI operation. All mounting styles available.

ESPECIALLY RECOMMENDED FOR

- **WELDING**
- **PUNCHING**
- **SHEARING**
- **CLAMPING**
- **RIVETING**
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and similar applications

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Miller

MILLER FLUID POWER DIVISION FLICK-REEDY CORP.

2018 N. Hawthorne Ave., Melrose Park, Ill.

AIR & HYDRAULIC CYLINDERS • BOOSTERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS

Precision Cuts on Ferrous or non-Ferrous Metals *Automatically* with STONE'S NEW MODEL M-75 BAR-FEED CUT-OFF MACHINE

MODEL M-75

M-75 FOR FERROUS METALS CUTTING: Now . . . cut up to 550 pieces per hour of 1½" solid rounds or other shapes with a mill-like finish, and with no change in metal characteristics! Even on the longest production runs, the M-75 holds tolerances of ±.005" day in, day out. That's due to Stone's exclusive Automatic Wheel Wear Compensator, which adjusts for fast approach and regulated speed of cutting cycle by hydrocheck. Cutting head is engineered with geared-in-head drive, another Stone exclusive, to deliver maximum power at lowest cost.

M-75 FOR NON-FERROUS CUTTING: Possesses most of the features of the M-75 described above, with the exception of Automatic Wheel Compensator. Handles solid stock up to 3½" in diameter, or 4" pipe and structurals . . . giving up to five times greater production.

M-35A MANUAL CUT-OFF MACHINE: Holds milled-finish tolerance of ±.005" on ferrous and non-ferrous materials at any degree of cut up to 45°—either direction. Geared-in-head drive. Cuts at less than 4 seconds per square inch.

55-20LR TRAVERSE TYPE MACHINE FOR CUTTING SHEET OR PLATE STOCK: Cuts 4', 8' or 12' lengths with great accuracy due to rigid construction of base, and work stop mounted parallel to kerf. Control-panel or hand operated as desired.

Be sure to see all the newest STONE Models at the METAL CONGRESS SHOW . . . BOOTH 2011

". . . represented in every major industry throughout the world"

STONE MACHINERY COMPANY, INC.
31 Fayette St. Manlius, N.Y.

Sales and Service in Principal Cities

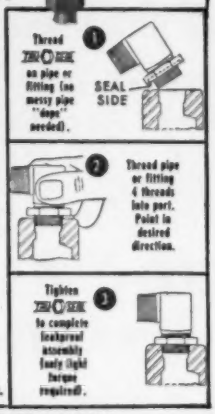
USE READER SERVICE CARD; INDICATE A-10-228-1

STOPS PIPE THREAD LEAKS instantly!

PAT. PENDING

Prevents future leaks!

TRU-O-SEAL does away with messy pipe "dope" compounds, eliminates damage caused by overtightening of conventional leaky joints, and is immune to ALL known hydraulic fluids and to steam, air, water, solvents, and practically all gases and chemicals. It withstands temperatures from —100° F. to plus 500° F., saves cost and labor of special or welded fittings, and has been fully field tested and proven by leading manufacturers. Comes in ⅛" to 2½" pipe thread sizes.


1
Thread TRU-O-SEAL on pipe or fitting (no messy pipe "dope" needed).
SEAL SIDE
2
Thread pipe or fitting 4 threads into port. Point in desired direction.
3
Tighten TRU-O-SEAL to complete leakproof assembly (only light torque required).

Write for data and prices

TRU-O-SEAL DIVISION
Flick-Reedy Corporation
2010 N. Hawthorne Melrose Park, Ill.

"Miller Fluid Power" is also a Div. of Flick-Reedy Corp.

USE READER SERVICE CARD; INDICATE A-10-228-2

SHEARCUTTER PREMIUM

THREAD BROACHES CUT TAPPING COSTS

IT'S NEW

Shearcutter Premium
THREAD-CUTTING BROACHES
deliver these advantages:

- End tapping trouble.
- Produce threaded holes by a Shearcutting action.
- Are practically unbreakable.
- Ground from hardened high-speed solid blanks.
- Require only half the power needed for tapping.
- Have an amazing long life.
- May be resharpened many times.
- Feed the chips out of the hole.
- Lower production costs.
- Replace standard taps in most sizes.

SHEARCUTTER TOOLS COST LESS IN THE LONG RUN

Those ultra-scientific cutting tools are used by practically every large manufacturing company in the U.S.A. Constant repeat orders prove their merit and value.

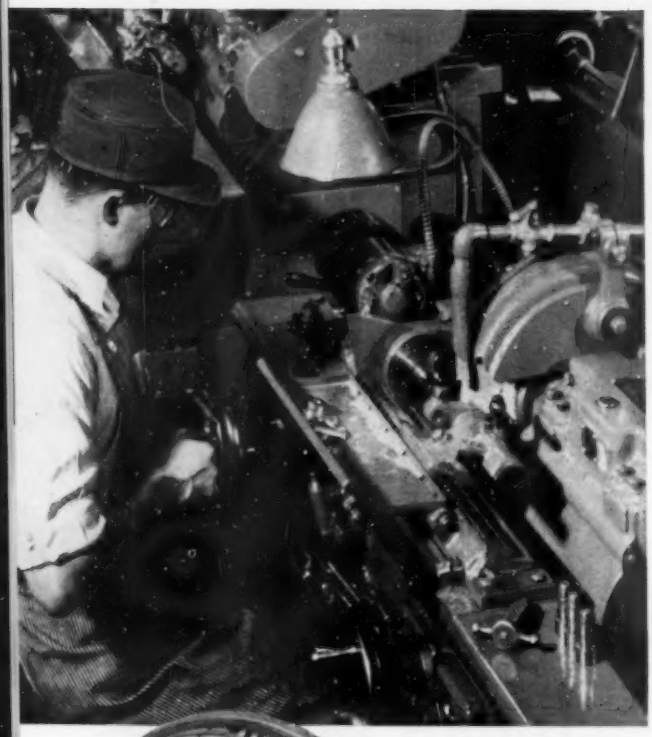
Patent Warning: All Shearcutter Tools are protected by U.S. and Foreign Patents, received, pending or applied for.

*ANOTHER AMAZING INVENTION OF RALPH GORDON FEAR

SHEARCUT TOOL CO.
MANUFACTURERS OF THE WORLD'S MOST SCIENTIFIC CUTTING TOOLS
7045 DARBY AVENUE RESEDA, CALIF

USE READER SERVICE CARD; INDICATE A-10-228-3

Sterling "sixth element" grinding wheels ...tailor-made to your job requirements



GRINDING WHEELS must be tailored exactly to your job requirements. To deliver top performance, they must combine, in just the right proportions, the five standard elements of a grinding wheel formula—abrasive grain, size, grade, structure, and bond. But in formulating *your* grinding wheel, Sterling also considers a *sixth element*.

The sixth element is the *human* element: the operator, his work habits, personal preferences, and all the other factors which can so greatly affect wheel performance. Sterling engineers know how to isolate this sixth element, then use it to produce a wheel tailored to the metal . . . the machine . . . and the man.

Because Sterling wheels are always formulated with the sixth element in mind, they can lower your grinding costs by prolonging wheel life, speeding grinding operations, and reducing downtime. For a thorough study of your grinding operation, call in a skilled Sterling abrasive engineer, or contact your nearest Sterling distributor.

For fast, repetitive work, such as this cylindrical grinding operation, a job-tailored Sterling grinding wheel will help you maintain production schedules, with minimum wheel consumption and maximum economy.

STERLING GRINDING WHEEL CO. TIFFIN OHIO
USE SAFETY GUARD · SEE A.S.A. SAFETY CODE
STERLING GRINDING WHEEL CO.
USE SAFETY GUARD · SEE A.S.A. SAFETY CODE
STERLING GRINDING WHEEL CO.
TIFFIN, OHIO

"Wheels of Industry"—Vitrified and Resinoid —to meet the exact requirements of industry.

STERLING GRINDING WHEELS

STERLING GRINDING WHEEL CO., TIFFIN, OHIO—SUBSIDIARY OF ABRASIVE AND METAL PRODUCTS COMPANY

TORRINGTON ROTARY SWAGING MACHINES...

featuring

- ★ maximum capacity for size and power
- ★ convenient location of controls
- ★ easy access for maintenance
- ★ integral storage space
- ★ modern styling and color

How the **new** *streamlined* Torrington Rotary Swaging Machines save material, labor and time

These modern swaging machines are versatile, efficient tools that shape metal by thousands of hammer blows each minute.

Many tapering, pointing, reducing and shaping operations can be done by swaging with these big advantages:

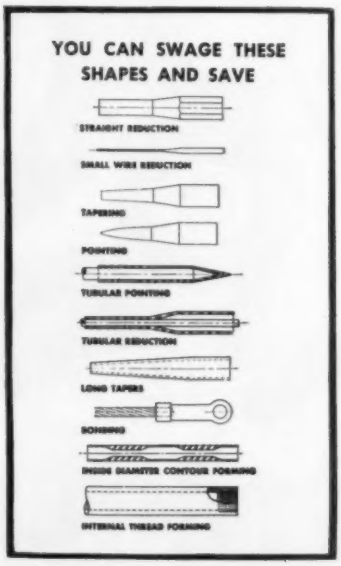
Swaging saves material that would otherwise be turned away as scrap.

It saves labor, performing many operations in a fraction of the time required by other methods.

It imparts greater strength, improved grain structure and a surface hardness that *only* hammering can produce.

It produces a fine burnished finish, usually to a closer tolerance than machining.

Torrington also supplies "Job-Tested" Swaging Dies, designed to your prints or to the part you wish to produce. Send us prints or a sample of your part, and we will advise you on selection of the proper machine for the work and supply the proper dies.



THE TORRINGTON COMPANY
Swaging Machine Division
444 North Street, Torrington, Conn.

TORRINGTON ROTARY SWAGING MACHINES
Makers of Torrington Needle Bearings

Jigs made of USS "T-1" STEEL

stand up best under gruelling turret lathe service!

Ever since the development and introduction of USS "T-1" steel, a number of interesting new applications of this strong, tough, readily weldable material have come to our attention. One of the most recent is its use by the A-1 Bit and Tool Company of Houston, Texas, for jigs on turret lathes. This company makes valves used to limit pressures in oil and gas lines. Here is what they say about their experience with USS "T-1" steel:

"In the past, when making jigs or fixtures, we had to make the parts, dowel and screw them together. The various parts had to be made of heat treated material or hardened before assembly to prevent warpage. All of which we found to be a slow and expensive process.

"Your new USS "T-1" steel has practically worked a revolution in A-1's jig and fixture design, because we can now machine the parts complete, weld them together, mount the jig on the machine and use it, as we find warpage in welding to be negligible."

Perhaps you, too, can switch to USS "T-1" steel with equally satisfying time- and money-saving results. For the full story of "T-1" steel, just fill out and mail this coupon.

U. S. Steel Supply Division
208 S. La Salle St.
Chicago 4, Ill.

Please send me full information on USS "T-1" Steel.

Name .....

Company .....

Address .....

City ..... State .....

U.S. STEEL SUPPLY

DIVISION

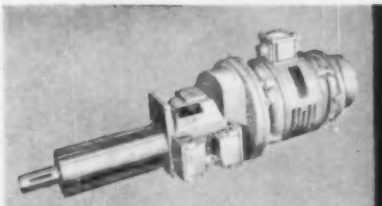
General Offices: **208 So. La Salle St., Chicago 4, Ill.** USS **Warehouses and Sales Offices Coast to Coast**

UNITED STATES STEEL

R-J UNITS

DRILL
TAP
INDEX
SCREW FEED

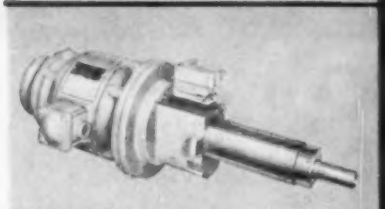
FOR BUILDING OR REBUILDING YOUR OWN MACHINES



DRILL UNITS

VERSATILE, EASY TO INSTALL

Made in 3 models, with overall range from ¾ to 5 h.p. Spindle speeds from 200 to 2400 r.p.m. Cam feed controls all cycle elements as required. Mounting is straight bored hole with flange bolts. Will drive multiple-spindle head. Made to J.I.C. standards or with direct drive.



TAP UNITS

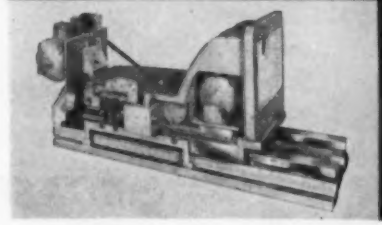
ACCURATE, STURDY, SIMPLE

Completely self-contained, with accurate, interchangeable lead screw and lead nut feed. Made in 3 models, with overall range from ¾ to 5 h.p. Spindle speed ranges from 100 to 1300 r.p.m., varying with different units. Mounting is straight bored hole with flange bolts. Can be arranged to drive multiple-spindle heads. Made to J.I.C. standards or with direct drive.

INDEX UNITS

RUGGED, SELF-CONTAINED

"Rim-Ball" construction, a heavy-duty bearing just inside edge of table all around, enables unit to support and easily rotate pieces of great weight. Belted or direct-drive index motor with brake. Modified geneva-type motion. Made in 8 sizes from 16" to 54" diameter, index positions from 3 to 12 inclusive. Flat surface mounting. Can be mounted vertically.



SCREW FEED UNITS

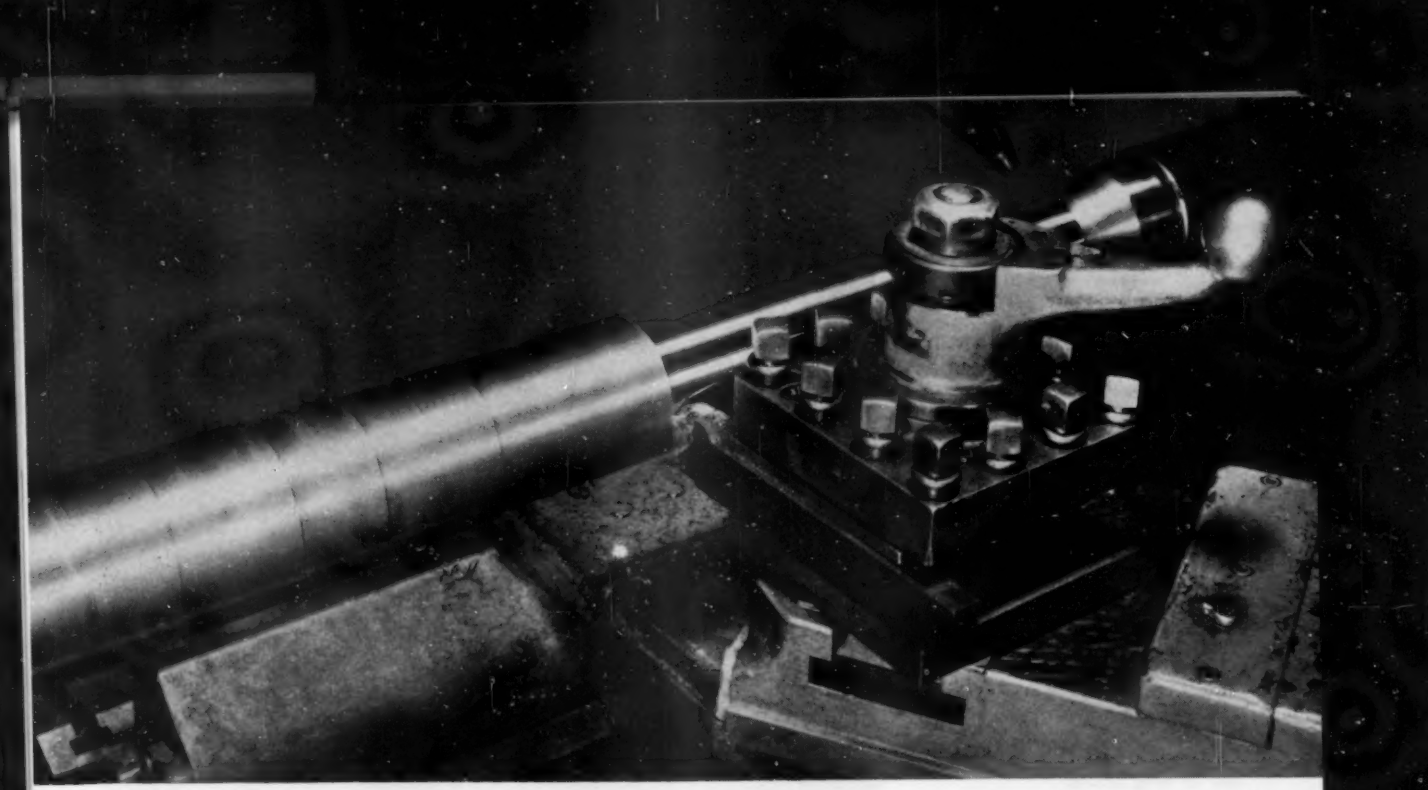
POWERFUL, ALL-MECHANICAL

Two-motor differential drive of feed screw and nut provides wide range and variety of feeds, working and rapid traverse, forward and return, which can be adjusted easily and quickly. Will take spindle drive motors up to 25 h.p. All-mechanical and completely self-contained for simple installation and easy maintenance. Fully assembled and tested. Made to J.I.C. standards.

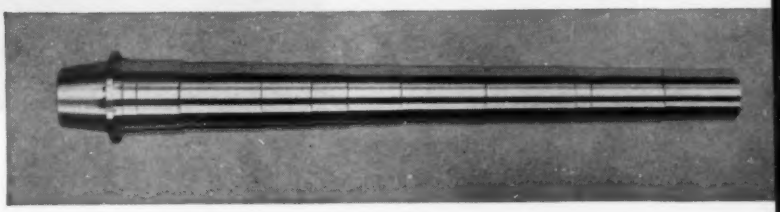
REHNBERG-JACOBSON
MANUFACTURING CO.
ROCKFORD, ILLINOIS

R-J

DESIGNERS, ENGINEERS
MANUFACTURERS AND
PRODUCTION CONSULTANTS



Carboloy Cemented Oxide finishes 31-inch lathe spindles in 2.8 minutes at R. K. LeBlond Machine Tool Co. Carbide tool used previously required 6 minutes. With the Cemented Oxide tool, the 12-step cut is made at 715 fpm – more than double the speed with carbide. Work finish is improved, and machine output is increased 45% per grind.



Takes up where carbides leave off...

FINISH STEEL WITH CARBOLOY CEMENTED OXIDE; GET FINER FINISHES AT HIGHER MACHINE SPEED

With new Carboloy® Cemented Oxide, you can finish steel faster than ever before possible. Specially developed for machining at speeds beyond the range of carbides, Cemented Oxide produces superior surface finishes, while reducing your machining costs.

Cuts faster, wears longer

Field and laboratory tests show Carboloy Cemented Oxide can be used effectively at speeds from 300 to 7500 fpm, on steels up to 300 Brinell. It cuts cleanly, resists edge wear and cratering at surface speeds which would quickly ruin other cutting materials.

Carboloy Cemented Oxide brings you two major advantages: It lets you cut faster – and therefore more efficiently – with your present equipment; it reduces the time required to complete a job. And, its unusual wear-resistance at these high speeds means less downtime for tool changes, lower tool and grinding costs.

Resists chipping, stays cool

Cemented Oxide is an entirely new kind of cutting material. It is harder than carbide, stronger and more resistant to chipping than typical ceramics. Even at extremely high operating speeds, the tip stays so cool it can be touched immediately after the cut.

With Cemented Oxide Grade 0-30 and the three Carboloy extra-performance carbide grades, you now have a specialized cutting material available for every steel-cutting job from roughing to super high-speed finishing. Limited quantities of Cemented Oxide Grade 0-30 are ready for evaluation on your finishing jobs. For information or technical bulletin, send the coupon on page 4 of this advertisement.

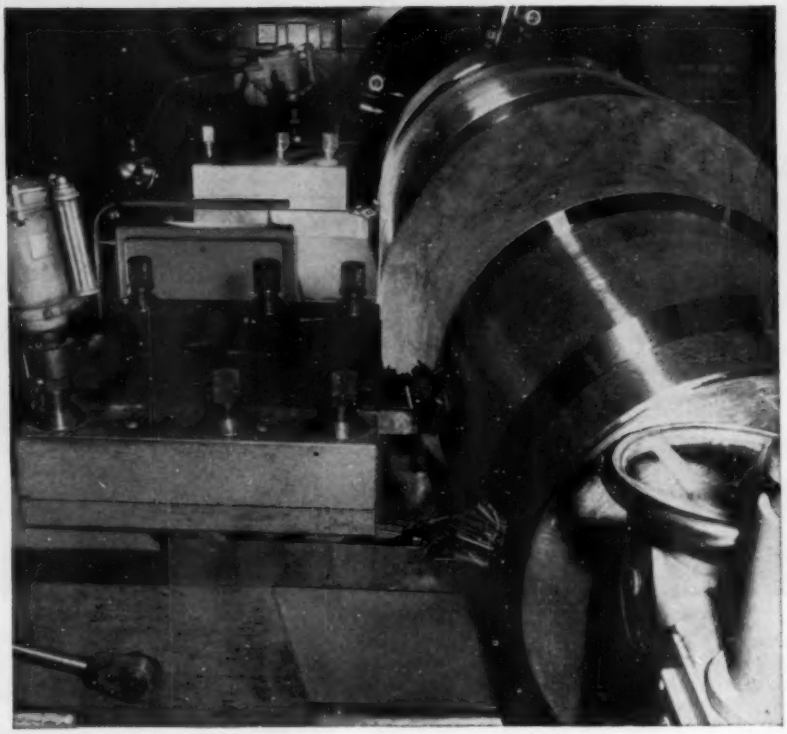
CARBOLOY
CEMENTED OXIDE

GRADE 370

EXTRA-PERFORMANCE CARBIDE FOR HEAVY-DUTY ROUGHING

Grade 370 is built to take heavier roughing cuts at higher speeds and feeds . . . yet outlast conventional carbides. Hundreds of in-plant tests have proved Grade 370 will remove more metal per minute – and take more regrinds – than any other grade.

For example, on huge steel backup rolls like the 31-ton roll at right, a single Grade 370 insert has removed 24,000 cubic inches in 2½ hours . . . without regrinding. Cutting through rough scale and hard seams, Carboloy Grade 370 tools will finish this job in 16½ hours.



For every job from roughing to finishing . . .

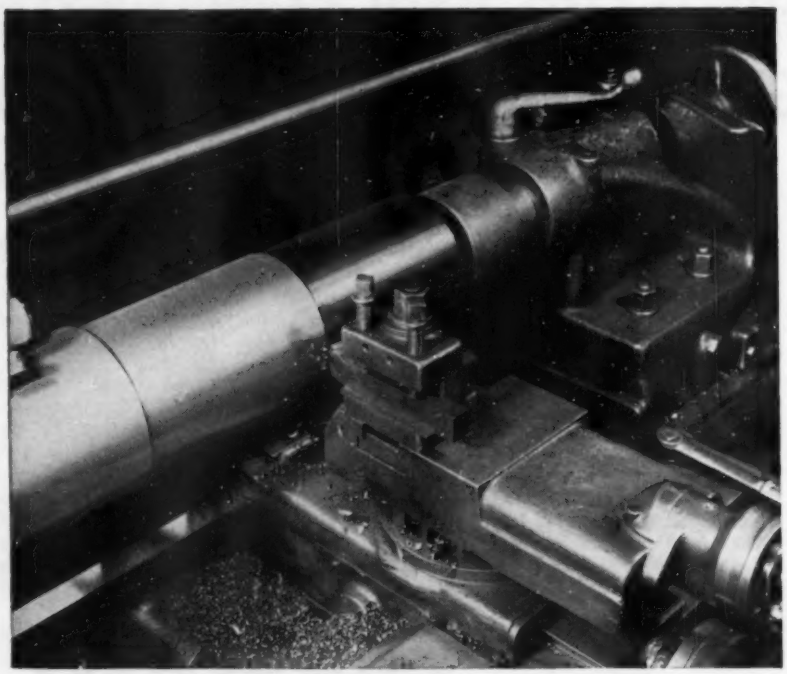
CUT STEEL FASTER, LOWER TOOL COSTS WITH

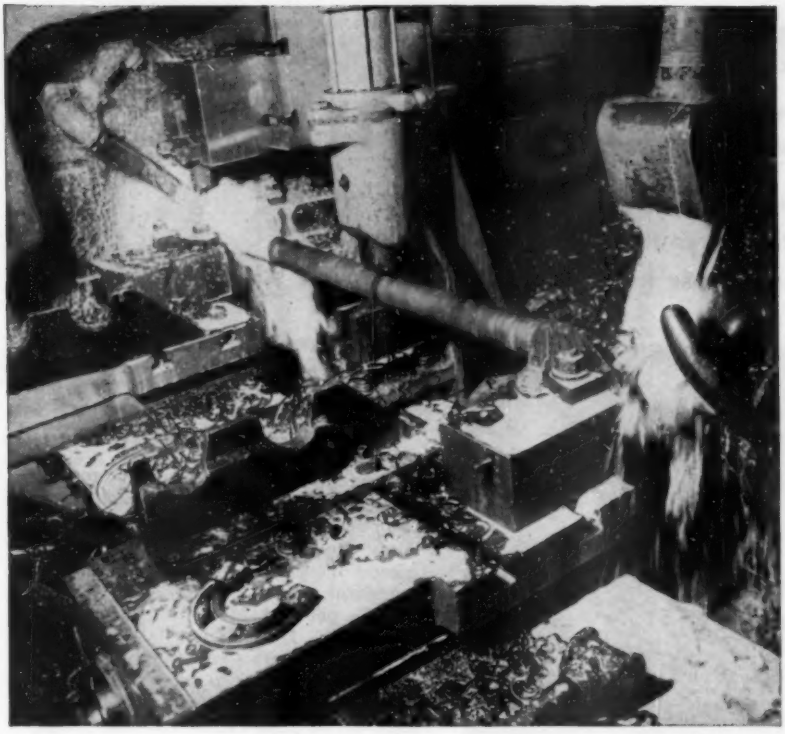
GRADE 330

EXTRA-PERFORMANCE CARBIDE FOR FINISHING AND BORING

New Carboloy Grade 330 is twice as strong as conventional steel-finishing grades. Its entirely new composition makes 330 easier to braze, yet more resistant to chipping. Unlike other finishing grades, Grade 330 is so tough it can be ground on automatic grinders without cracking.

Grade 330 can take speeds 10% higher than other carbides, without loss of tool life. When compared at a series of speeds ranging from 600 to 1900 fpm, Grade 330 outlasted other grades by 20%-35%. (Picture at right shows surface finish obtained on S.A.E. 1045 steel at 800 FPM.)





GRADE 350

EXTRA-PERFORMANCE CARBIDE FOR MEDIUM-DUTY MACHINING

Grade 350 was specially developed to increase your machines' efficiency in the light roughing and general finishing range. Built-in structural rigidity enables Grade 350 to withstand steel-cutting conditions which quickly cause tip deformation in ordinary carbides. Its extra strength gives you more production per grind, more grinds per tool.

For example, in machining the AISI 4150 truck axle forging at right, Grade 350 boosted production 33%. In addition, Grade 350 eliminated chipping and flaking encountered with other carbides.

CARBOLOY EXTRA-PERFORMANCE CARBIDES

- **Take heavier, deeper cuts with Grades 330, 350, 370**
- **Get increased production from machines and manpower**

Announcement of new Grade 330 means you now have a choice of *three* Carboloy extra-performance steel-cutting carbides.

New Grade 330 takes up on finishing and boring jobs where medium-duty Grade 350 leaves off. And together with heavy-duty Grade 370, these carbides offer you faster cutting at lower cost over the complete steel-cutting range from roughing to finishing.

Outperform conventional carbides

Service-proved on thousands of applications like the ones above, these grades consistently outperform conventional carbides. Even at higher speeds and feeds, they take heavier, deeper cuts . . . yet outwear other grades.

Their superior strength means more production per hour, greater output per machine. Their resistance to wear means less downtime, fewer wasted man-hours for tool changes, and lower tool costs.

Complete line stocked locally

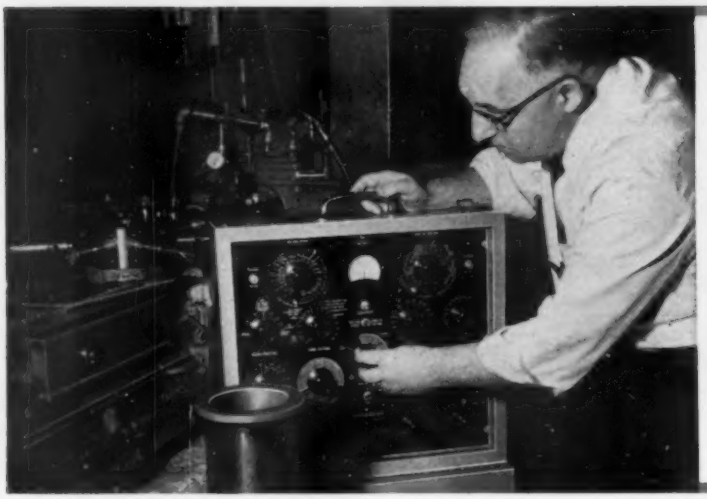
All three of these extra-performance carbides are stocked locally by your Authorized Carboloy Distributor. They are available in a complete line of standard tools and blanks, as well as inserts for your toolholders.

Try these extra-performance carbides in your plant . . . and see why there is no such thing as an "equivalent grade" for Carboloy 330, 350, and 370. For more information, see your Carboloy Distributor, or mail the coupon on page 4 of this advertisement.

CARBOLOY
CEMENTED CARBIDES

CUT MACHINING COSTS, SAVE SETUP TIME WITH CARBOLOY MACHINABILITY COMPUTER

- ▶ **Determine most efficient cutting conditions in seconds**
- ▶ **Eliminate wasteful tryout runs, save valuable stock**
- ▶ **Get closer control over inventories and production schedules**



How the Machinability Computer is helping Scully-Jones and Co.

Original operating standard for machining expanding shells called for 244 minutes per part. But by calculating the optimum combination of speeds, feeds, and other data on the Computer, the company saved 77.8 minutes per part. Machining time was cut 32% . . . 17 machining hours were saved on a 13-piece run. Scully-Jones used the Computer to determine correct setups for both HSS and carbide tools—on turning, facing, drilling, and boring jobs.

Scully-Jones and Co., Chicago, is just one of hundreds of plants now getting greater production from their machines by using the Carboloy Machinability Computer.

Machining data are fed into the Computer . . . and in seconds, optimum speeds, feeds, horsepower ratings, or any of 16 other operating variables are accurately figured for the machinist.

On the job above, for example, the Computer showed how to cut machining time 32% on a 13-piece run . . . saving 17 machining hours and eliminating wasteful tryout runs.

Benefits extend plant-wide

On other jobs throughout the plant, the Computer establishes new operating standards, corrects and verifies existing ones . . . in a fraction of the time previously required.

In addition, the Computer simplifies inventory problems by predicting rate of tool wear. It aids grinding rooms plan work loads; helps management coordinate production schedules. The Computer is a versatile engineering tool for any sized plant.

Ask for demonstration

Price of the Carboloy Machinability Computer is $495, f.o.b. factory, Detroit. It is battery-operated, portable, and rugged; can be used by anyone with machining experience after a short familiarization period.

For more information on how the Computer can help your plant increase production and reduce manpower costs, mail the coupon below. If you wish, we will gladly arrange a demonstration in your plant.

CARBOLOY
MACHINABILITY COMPUTER

Metallurgical Products Department
General Electric Company
11101 E. 8 Mile Ave., Detroit 32, Mich.

Send me information on the following products:

- ☐ Carboloy Cemented Oxide Grade 0-30
- ☐ Steel-Cutting Grades 330, 350, and 370
- ☐ Carboloy Machinability Computer
- ☐ Have a representative make an appointment to demonstrate the Computer

Name_____
Title_____
Company_____
Address_____
City_____ Zone_____ State_____

Carboloy is a trademark of General Electric Company

AT THE METAL SHOW: **"New Worlds in Metalcutting" with Carboloy Cemented Oxide and Carboloy carbide grades 330, 350, and 370. *Booth No. 2124.***

Tear this chart out and preserve it

YOUR GUIDE TO COLUMBIA HIGH SPEED TOOL STEEL GRADES

TYPE AND GRADES	DESCRIPTION	HARDENING RANGE	QUENCH	TEMPERING RANGE	USEFUL HARDNESS
T1 — CLARITE	Standard type, high red hardness, good strength, wide range of use with high over-all efficiency	2000° F. to 2350° F.	Oil or Salt Bath	1000° F. to 1250° F.	65/60 Rc
T2 — VANITE	Increased carbon and vanadium; best for form tools and finishing cuts	2300° F. to 2375° F.	Oil or Salt Bath	1000° F. to 1050° F.	66/63 Rc
T4 — ACMITE	18-4-1 high speed steel with 5.00% cobalt added; for heavy cuts, all around high speed cutting with long life at high speeds.	2325° F. to 2375° F.	Oil or Salt Bath	1000° F. to 1025° F.	66/64 Rc
T5 — COBITE	18-4-2 with 8.00% cobalt high speed steel, extreme red hardness, for hogging cuts on scaly and hard abrasive materials	2325° F. to 2375° F.	Oil or Salt Bath	1000° F. to 1100° F.	66/64 Rc
T8 — MAXITE	High carbon, high vanadium with 5.00% cobalt. High production steel for cutting hard castings and tough heat treated alloy steels	2325° F. to 2375° F.	Oil or Salt Bath	1025° F. to 1075° F.	66/63 Rc
M2 — MOLITE SMOOTHCUT	Molybdenum-tungsten multipurpose high speed steel with smoothcutting additives for greatest economy	2100° F. to 2275° F.	Oil or Salt Bath	1000° F. to 1250° F.	66/58 Rc
M3 — MOLITE 3	Molybdenum-tungsten high speed steel with higher carbon and vanadium for fine cuts including broaching and reaming	2175° F. to 2250° F.	Oil or Salt Bath	1000° F. to 1100° F.	66/63 Rc

COLUMBIA TOOL STEEL COMPANY • CHICAGO HEIGHTS, ILLINOIS

CENTRAL OFFICE AND WORKS, CHICAGO HEIGHTS, ILLINOIS — BRANCH STOCKS IN THE FOLLOWING CITIES:

Chicago 32, 4832 S. Kedzie Ave., Phone LAfayette 3-3632
Cincinnati 25, 2716 Spring Grove Ave., Phone MUlberry 1-8400
Cleveland 14, 1640 St. Clair Ave., Phone MAin 1-1785
Detroit 3, 121 Oakman Blvd., Phone TUlsa 3-3770
Los Angeles 22, 6955 E. Bandini Blvd., Phone RAymond 3-4684
Milwaukee 4, 426 S. Sixth St., Phone BRoadway 6-0255
St. Louis 13, 5118 Easton Ave., Phone FOrest 1-0641

REPRESENTATIVES IN THE FOLLOWING CITIES: Dayton, Erie, Grand Rapids, Hartford, Indianapolis, Louisville, Moline, Newark, Portland and St. Paul

1957

TOOL COLUMBIA STEELS

COLUMBIA TOOL STEELS

DIE STEELS: Superdie — Atmodie — E-Z-Die Smoothcut — Exl-Die — CEC Smoothcut HOT WORK STEELS: Clarite HW — Formite #3 — Formite #2 — Molite HW10 — Vanadium Firedie — Alcodie — Firedie CARBON TOOL STEELS: Columbia Special — Vanadium Extra — Waterdie Extra — Columbia Extra — Columbia Extra Headerdie — Vanadium Standard — Columbia Standard

GADGETS CONTEST!

If you've thought up an interesting device that makes toolroom or production jobs easier, safer or more efficient, there's still time for you to enter the Gadgets Contest.

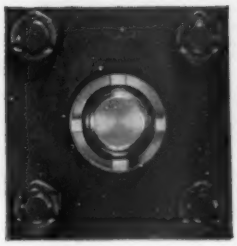
Early entries in the contest have contained many ideas which are of real practical value to tool engineers. They are ideas you won't find in any handbook, but they are valuable contributions to America's productive know-how.

Take a look at the Gadgets contained in the Gadgets Department of any issue of THE TOOL ENGINEER. They are typical of the sort of idea we are talking about.

Then sharpen up your pencil and get to work. Write a brief description of your Gadget, enclose a simple sketch and send your entry along. You many win one of the seven cash prizes and you'll have the satisfaction of knowing that your idea may be of real value to fellow tool engineers.

Gadgets Contest Rules

1. ELIGIBILITY: This contest is open to all members of the American Society of Tool Engineers.
2. DEFINITION: "Gadgets" are defined as tools or methods developed to solve specific production problems. They should contain a useful and practical idea or indicate an ingenious solution to a tool engineering problem.
3. PRIZES: One $100 first prize, two $50 second prizes, four $25 third prizes, and honorable mention awards consisting of copies of the *Tool Engineers Handbook* or *Die Design Handbook* published by the American Society of Tool Engineers. Certificates will be awarded to all prize winners.
4. PERIOD: The contest will run until December 31, 1956. All contributions to the Gadgets Department received from ASTE members during the period of the contest will be considered as entries.
5. JUDGING: Entries will be judged on the basis of originality, conciseness and completeness of presentation, and usefulness to other tool engineers. Members of the ASTE National Editorial Committee will serve as judges. Winners will be notified by mail as soon as possible after completion of judging. A list of winning entries will be published in THE TOOL ENGINEER.
6. ENTRIES: The name and chapter affiliation of the author should be written on each page of the entry. No entries will be returned. All publication rights are assigned to THE TOOL ENGINEER. Authors of entries published in THE TOOL ENGINEER will receive honorariums. Information which has been published previously is not eligible.
7. LENGTH: Entries should be limited to 500 words or less. Sketches or photographs should be used to illustrate the methods or devices described in the text of the entry.
8. MAIL ENTRIES TO: Gadgets Contest Editor, THE TOOL ENGINEER, 10700 Puritan Ave., Detroit 38, Mich.



Here are the world's finest power cylinders

...competitively priced!

This ad is written for the man who has thought all cylinders are "pretty much alike." That just isn't so, and your Hannifin man would like an opportunity to show you why...

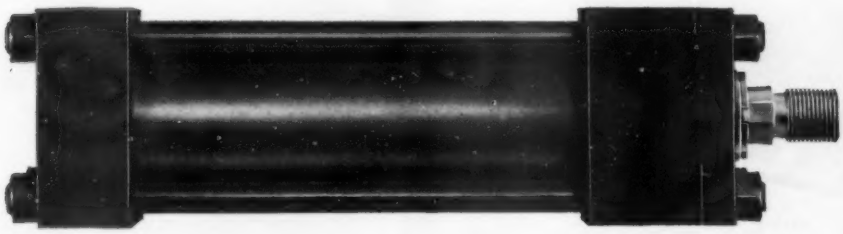
He'll show you design features that other cylinders simply do not have... extra quality workmanship at critical points that pays off in longer life ...accessibility that simplifies their infrequent maintenance. And when he talks price and delivery, you will find these better features cost you no more, can often be delivered sooner.

We think you'll agree that it pays to standardize on Hannifin cylinders.

AIR AND HYDRAULIC

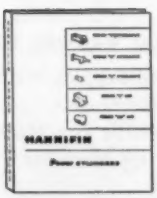
HANNIFIN

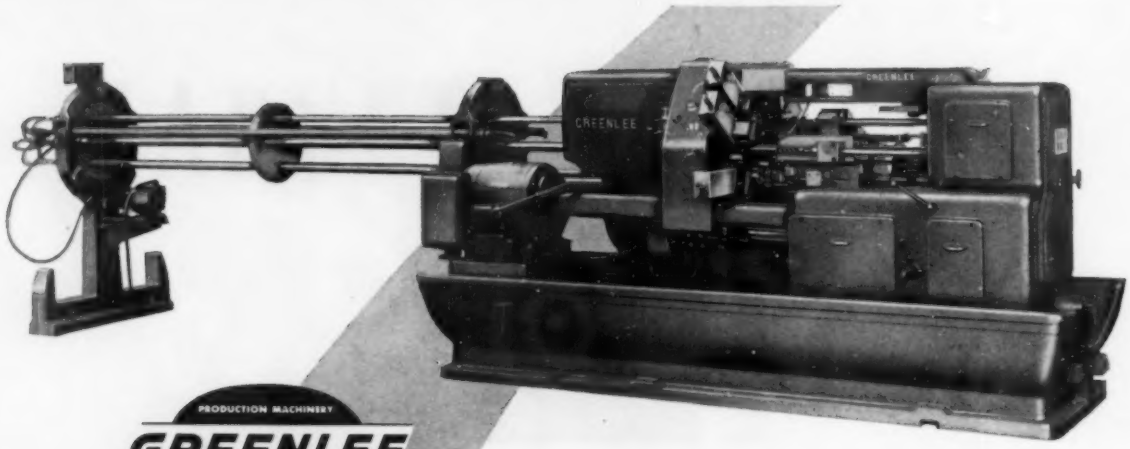
POWER CYLINDERS



COMPLETE CYLINDER FILE

Write for your copy of this new Hannifin Cylinder File . . . complete, easy-to-use, easy-to-order-from information on five lines of Hannifin Cylinders. Write Hannifin Corporation, 519 S. Wolf Road, Des Plaines, Ill.





PRODUCTION MACHINERY
GREENLEE

AIR-FEED AUTOMATIC

- **1** Permits Greater Job Versatility
- **2** Easily Adapted to Multiple Feedouts
- **3** Provides Longer Stock Feedout
- **4** Eliminates Stock Scoring
- **5** Reduces Stock Reel Noise
- **6** Eliminates Stock Pushers
- **7** Eliminates Feedout Cams

Write today for Catalog A-405, or better still, have the Greenlee man call and show you the way to more profitable production with this air-feed automatic bar machine.

GREENLEE STANDARD AND SPECIAL MACHINE TOOLS

- Multiple-Spindle Drilling and Tapping Machines
- Transfer-Type Processing Machines
- Six and Four-Spindle Automatic Bar Machines
- Hydro-Borer Precision Boring Machines

GREENLEE BROS. & CO.

PRODUCTION MACHINERY
GREENLEE

1990 MASON AVE.
Rockford, Illinois

C I B A

Araldite®
First in Epoxies

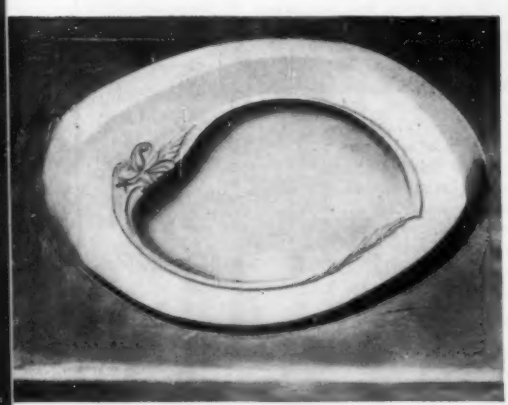
Wherever great strength with light weight, excellent electrical properties, chemical resistance, and an ability to adhere to almost every kind of surface are needed, Araldite "Double Check"* Epoxy Resins are ready to step in with this unbeatable combination of properties unavailable before in one class of basic resins. Results? Case histories like these to point the way to advance your own engineering planning and stream-line production with overall savings in time and money that will bring the all-important "plus" to your profit picture!

SLASHES TOOLING COSTS UP TO 40%!
This die for the forming of airplane part shown is fabricated with a ½" facing of Epoxy Resin over a rough kirksite casting. Time formerly spent on grinding with a blue block is eliminated, and tooling costs are slashed up to 40%.

Formulator: Furane Plastics, Inc.
Customer: Lockheed Aircraft Corp.

LOW COST RETREAD REDEEMS COSTLY DIES!
Details of worn dies, which would cost thousands of dollars to reclaim by former methods, are easily refaced and put back into use by casting Epoxy Resin against a pattern, or actual part. Male punch is faced with a flexible Epoxy formulation.

Formulator: Rezolin, Inc.
Customer: R. Wallace & Sons Mfg., Co.



The Technical Services of Ciba's Plastic Division are the finest in their field. For full information on how Ciba Araldite Epoxies lead to product development and production improvements, write...

*Ciba Araldite Epoxy Resins come with the assurance that they have met not only our rigid PRODUCTION quality control standards but the specific APPLICATIONAL requirements of the user as well.

Ciba produces basic resins only which are formulated for intermediate and end uses by accredited formulators.

CIBA COMPANY INC., Plastics Division
627 Greenwich St., New York 14, N. Y.

TE-10

Please send me full information on CIBA Epoxy Resins for

☐ Tooling ☐ Structural Laminates ☐ Surface Coatings
☐ Electrical ☐ Hi-Strength Adhesives ☐ Plastic Body Solders

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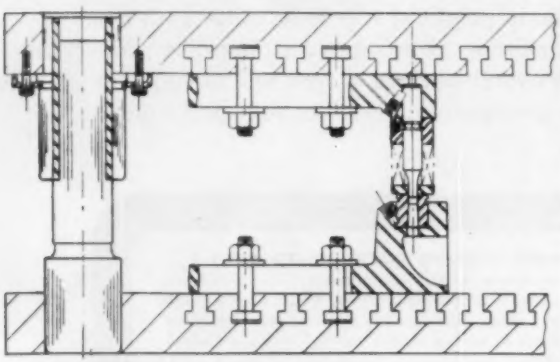
ADDRESS_____

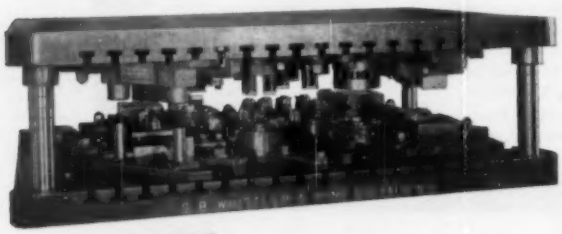
CITY_____ STATE_____

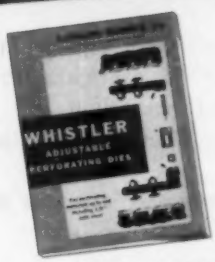
ADJUSTABLE DIES by WHISTLER

• Operate like a single purpose die • Easy to set-up and make changes • Interchangeable and re-usable parts always ready for a new job • Reduce die costs to a new low • Pierce holes in any desired arrangement of shapes and sizes • Precision piercing of materials to ¼" thick steel.



Above: Sectional drawing of a Whistler adjustable punch and die unit assembled in T-slot die set. **Below:** A completely assembled Whistler adjustable die ready for the press.





YOU NEED THIS CATALOG

to see for yourself in dollars and cents what this adjustable die making method can do for your plant. Send for it right now...without obligation.

S. B. WHISTLER & SONS, INC.
744 Military Road, Buffalo 23, N.Y.

ADJUSTABLE, MAGNETIC and CUSTOM DIES FOR ALL INDUSTRY
Direct Factory Representatives Located in Principal Industrial Areas

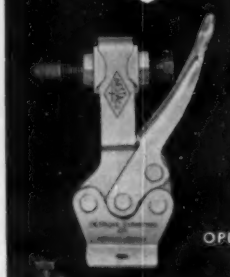
Visit us at Booth 2014—National Metal Exposition, Cleveland—Oct. 8-12

USE READER SERVICE CARD; INDICATE A-10-242-1

BRAND NEW...

DE-STA-CO **MIDGET-U** (MODEL 215-U) **TOGGLE CLAMP!**

...with articulated linkage and low closed-silhouette...



Midget-U is an ideal tiny clamp for light-duty jobs requiring almost effortless positive clamping. . . . It has limitless applications for clamping metal, plastic and wood parts . . . Weighs only 4 oz. . . . Delivers 150 lbs. holding pressure. . . . Total length when closed—5⅞"!

OPEN POSITION shows fine articulated linkage of components

CLOSED POSITION shows its low silhouette

Send for Literature on this new DE-STA-CO Midget-U Toggle Clamp!

DE-STA-CO **DETROIT STAMPING COMPANY**
WORLD'S FIRST LINE OF TOGGLE CLAMPS
320 Midland Avenue • Detroit 3, Michigan

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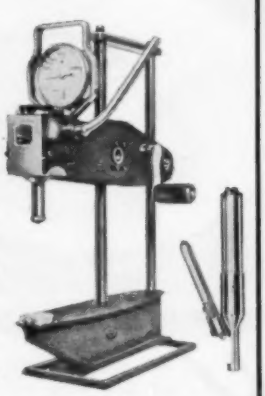
THE KING PORTABLE BRINELL HARDNESS TESTER

Known the World over for Accuracy & Dependability
Takes Brinell Tests in Hard to Reach Spots

King Portable Brinell Hardness Testers are rugged, accurate and easy to operate. They give trouble free versatile performance, and guaranteed accurate readings in spots that no other tester can reach.

King Hardness Testers can be carried anywhere, and can make tests in any position. They put a full load of 3000kg on a 10mm ball—other loads as required. 5mm and 10mm carbide balls used for castings and hard materials.

Gap 13½" high, throat 4" or 6", Test Head removable for testing larger parts. Weight only 28 lbs.



For complete specifications on standard testing machines or adaptations made to your special requirements, write

KING TESTER CORPORATION
Dept. T, 440 North 13th St., Philadelphia 23, Pa.

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9 design problems that can be met with the... Allenut

Ever-increasing applications for the new ALLENUT have caused sales to double within the past two years. Here are some of the things it can do to aid your product designing:

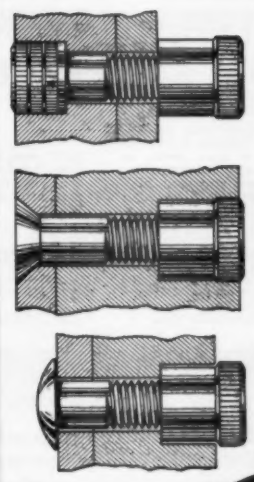
1. Self-anchoring in any metal. Allenut provides positive anchoring action through its hardened knurls.

2. Compact design. Requires no space for box wrenching. 12-point socket permits tightening in awkward places.

3. Smooth surfaces. Fits flush or below surface in counterbored hole . . . permits streamlined, safe surfaces.

4. A ready-made, hardened, tapped hole. When used as a bushing, prevents costly stripping of threads caused by frequent removal and replacement of screw or bolt. In castings and other soft metals a stripped hole can be counterbored, an Allenut inserted and the same bolt or screw used.

5. Tighter fit. Greater thread contact than with ordinary nuts because of Class 3 fit. Weld-like setups accomplished with one hand wrenching. Allenut holds firm against turn of screw.



6. Usable with any type of bolt or screw. Permits space-saving, internal wrenching of cap screws, T bolts, machine bolts, and other common fasteners.

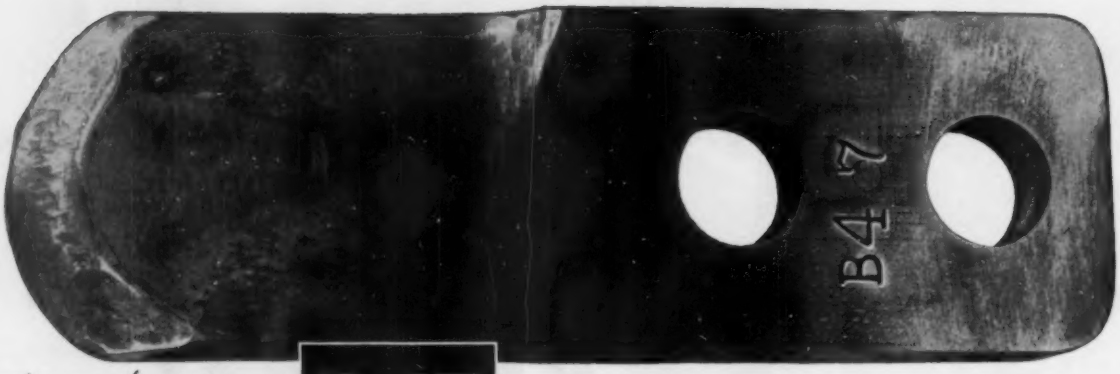
7. Saves parts. No washers required when anchored.

8. Easier to use. Knurled ring facilitates fingering-in. Allenut is always square to counterbored hole. Removable by hitting screw or bolt head with tap of a hammer.

9. Reusable indefinitely. Anchoring action remains unimpaired. Hardened threads and socket stand up under repeated removal and replacement.

Allenuts are available in a full range of 14 standard sizes from no. 4 to 1" from leading industrial distributors.

We welcome your inquiry and request for engineering details on Allenut applications.



This punch gave double service!

B-47 HOT WORK STEEL

gives you more runs for your money

...anywhere from **1½** *to* **5** *times the Performance!*

This block had double life!

This die lasted 50% longer!

SOME TYPICAL EXAMPLES

B-47 dummy blocks, vs. 9% and 12% tungsten types, extruded more than twice as many brass and copper tubes. B-47 dies outperformed 12% tungsten type 1½ to 1.

B-47 punches, vs. low-carbon 18-4-1 type, hot pierced more than twice as many eyes in steel axes. See top picture.

B-47 die inserts, vs. 9% tungsten types, hot pressed more than twice as many steel side gear forgings. B-47 die inserts, vs. regular insert material, performed better than 5 to 1.

B-47 dummy blocks, vs. 5% tungsten-5% chromium types, extruded twice as many copper and brass tubes and rods. B-47 dies outperformed 12% tungsten-12% chromium type.

B-47 punches, vs. 5% chromium type, hot extrusion forged 1½ times as many automotive steel front axle spindles.

B-47 die inserts, vs. 9% tungsten types, extruded 1½ times as many high alloy steel automotive valves. This is considered a very difficult job for any grade of hot work steel.

SEND NOW

for "Blue Sheet" on Grade B-47

This four-page folder gives technical data on B-47 for brass extrusion dummy block and dies, valve extrusion die inserts, hot punch tools, forging die inserts, press forging dies, and hot work in general. *Write for your copy today.*

ADDRESS DEPT. TE-82

Looking for a better hot work steel? You'll find it in B-47—an improved chromium, tungsten, cobalt, vanadium type whose superiority is established by actual performance runs such as those summarized above. All tests show that B-47 has unusual resistance to shock and abrasion at elevated temperatures.

Developed originally for applications in the copper and brass industry, B-47 has given excellent results on difficult hot work jobs on steel. B-47, when properly heat treated, exhibits a well rounded combination of red hardness, toughness, and resistance to wear and heat checking that makes it a valuable addition to the Allegheny Ludlum group of hot die steels.

Put B-47 to the test. You'll find that it will do any number of severe hot work jobs without washing out or changing size. Get in touch with A-L, today. Let us help you to use B-47.

● *Allegheny Ludlum Steel Corporation, Henry W. Oliver Bldg., Pittsburgh 22, Pa.*

For complete MODERN Tooling, call

Allegheny Ludlum

AL FINE TOOL STEELS SINCE 1854

WSW 6284

NEW OAKITE CLEANERS
GIVE YOU MORE FOR YOUR
PAINT-PREPARATION DOLLAR

Here are 6 ways to end pre-paint metal-cleaning troubles

Does your trouble chart show that you need better cleaners, strippers or surface conditioners?

- ☐ Cleaning solution foams excessively in spray washing machine. See 1 below.
- ☐ Streaky discolorations or powdery residues cling to surface of steel parts being stripped for repainting. See 2.
- ☐ Aluminum parts are severely etched while being stripped of zinc chromate primer or other finishes. See 3.
- ☐ Zinc phosphating process too difficult to control—requires too many titrations, too many additions, etc. See 4.
- ☐ Iron phosphating process doesn't show good results in salt spray tests. See 5.
- ☐ Too many operations—cleaning, pickling, neutralizing, etc.—are needed to prepare steel that does not require phosphating before painting. See 6.

Here are brief descriptions of new Oakite materials designed to end these particular troubles:

1. For a spray washing solution that does not foam at high pressure, try Oakite Composition No. 161. Does not attack aluminum.
2. For stripping pigmented paint, phosphate coatings and undercoat rust *in one operation,* try Oakite Rustripper.
3. For safe, thorough stripping of aluminum, try Oakite Stripper No. 110.
4. For a zinc phosphating process that is truly easy to control, try new Oakite CrysCoat SW. No accelerators, starters or toners. Only one material used for make-up and up-keep
5. For salt spray results far beyond the capacity of ordinary phosphating processes, try new Oakite CrysCoat No. 89.
6. For *one-operation* removal of rust, heat scale, welding residues and light soil together with good preparation for painting, try Oakite Compound No. 131. Inhibited against attack on steel.

FREE Check the coupon and we will send you free booklets or bulletins containing complete information on the new Oakite materials in which you are interested.

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OAKITE
MATERIALS · METHODS · SERVICE
SCIENCE

Technical Service Representatives in Principal Cities of U. S. and Canada

Export Division Cable Address: Oakite

OAKITE PRODUCTS, INC.
58 Rector Street, New York 6, N.Y.

Send me free booklets or bulletins giving complete information on the new Oakite materials checked below:

- ☐ Oakite Composition No. 161
- ☐ Oakite Rustripper
- ☐ Oakite Stripper No. 110
- ☐ Oakite CrysCoat SW
- ☐ Oakite CrysCoat No. 89
- ☐ Oakite Compound No. 131

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Company _____

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Spiramatic
JIGMILS®

for
ULTRA-PRECISION BORING and MILLING

THE "ACCEPTED" MACHINE FOR JIGLESS PRODUCTION OR ONE-PIECE JOBS

The DeVlieg System of "JIGLESS BORING"— ★ Eliminates expensive jigs ★ Permits complete flexibility of product design ★ Insures interchangeable assembly of parts without hand fitting.

DeVlieg JIGMILS are widely used in toolrooms and experimental shops for machining all types of jigs, fixtures and experimental parts to precise limits of accuracy with a minimum of operator skill.

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Write for Illustrated Catalog

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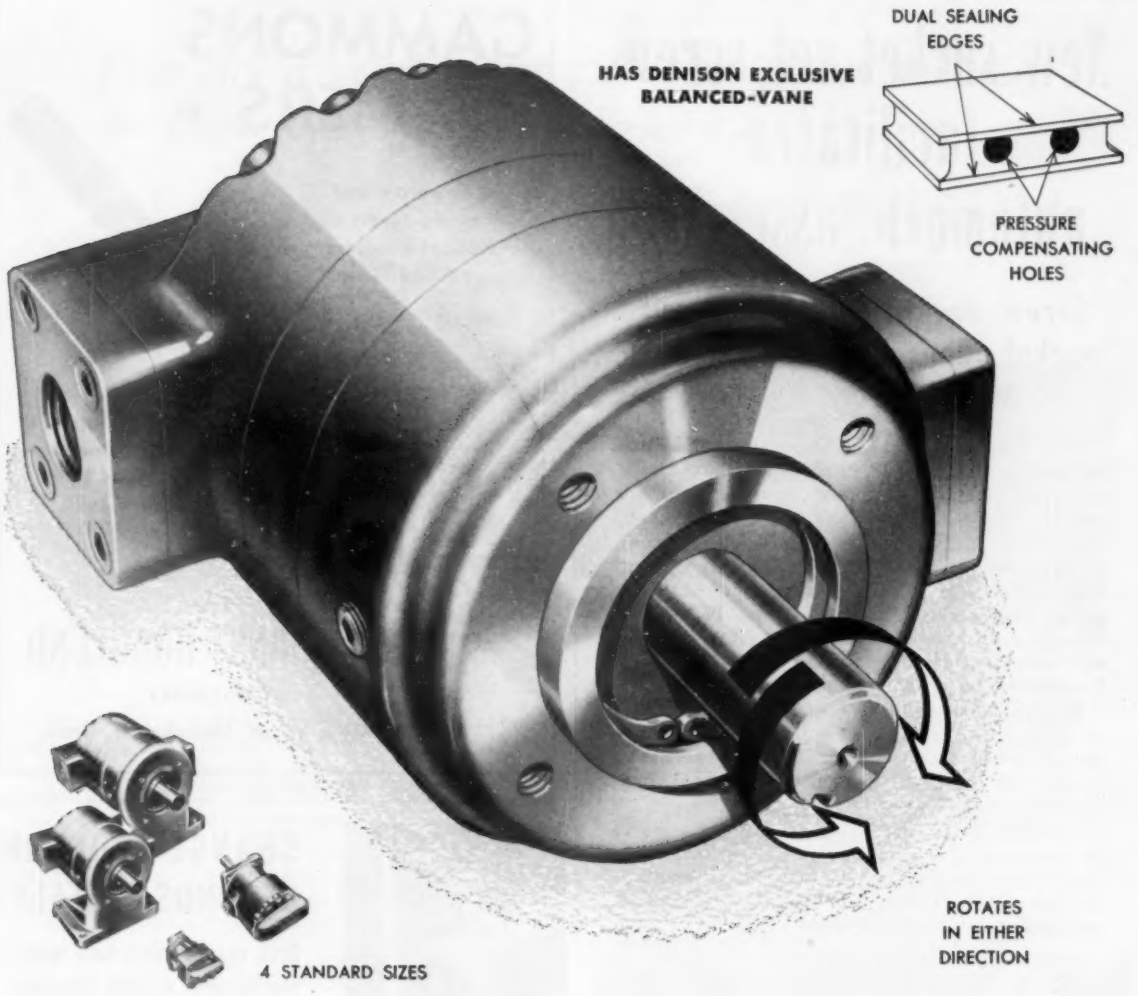


for continuous 2000 psi service...

Vane type Denison hydraulic single stage, Pump/Motor

IT'S A PUMP—high delivery in a small, compact package . . . a continuous 2000 psi pump.

IT'S A MOTOR—high stalled torque up to 257 pound-inches per 100 psi. Takes high shock pressures without danger.

EXCLUSIVE—Denison *Radially Balanced* Vane; *Cuts wear* between cam ring and vane; *Increases efficiency* with dual sealing edges; *Reduces pulsation* by radial pumping action of vanes.

SIMPLIFIES INVENTORY

No need to stock separate pumps and motors. Runs as a pump or motor without alterations. Range of capacities in each size through interchangeable cam rings.

EITHER DIRECTION—Operates efficiently as a pump or motor without change in piping. Minimum internal friction in either direction because of greatly reduced contact pressure between vanes and cam ring.

STANDARD SIZES—as a pump, Range of delivery 2.5 to 77 gallons per minute at 2000 psi.
As a motor, Horsepower output 1 to 103 hp at 2000 psi.

MORE INFORMATION—Send for Bulletin P-5-A giving complete specifications. Write . . .

DENISON ENGINEERING DIVISION
American Brake Shoe Co.
1182 Dublin Road • Columbus 16, Ohio

DENISON HydrOILics
HYDRAULIC PRESSES • PUMPS • MOTORS • CONTROLS

SOCKET SCREW ENGINEERING DATA

New socket set screw facilitates automatic assembly

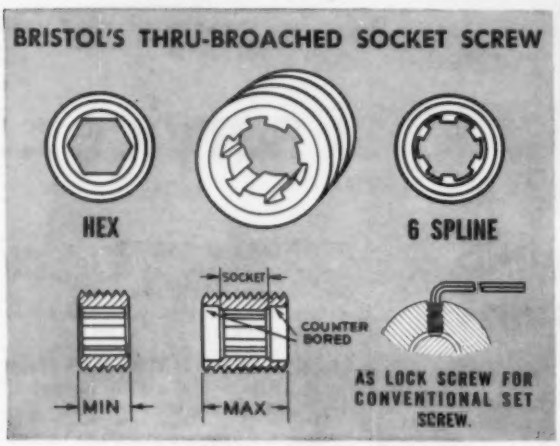
Screw design with full-length socket eliminates slow, tedious handling of tiny set screws

Slow production, operator fatigue, large floor area requirements are a few of the difficulties encountered with hand assembly of components fastened by small wire-size socket set screws.

Bristol's new, patented Thru-Broached socket set screw overcomes all of these difficulties by making automatic assembly of the small screws practical. The socket goes entirely through the center of the new screw so that it can be wrenched from either end with equal ease, facilitating hopper feed (either end up) to an automatic power screw driver.

Hopper feeding and power driving increase the rate of assembly and reduce the required assembly bench area. Operator fatigue is alleviated with automatic handling of the tiny fasteners. What's more, cross-threading of small screws is greatly reduced.

The holding power of these new screws equals that of conventional cup-point socket set screws; thus they're interchangeable with conventional screws of the same diameter. Write for complete data on this outstanding new socket set screw. A.6.10



Precision Socket Screw Manufacturers Since 1913

"Made in sizes as small as No. 0 in Alloy Steel and Stainless Steel. Cap Screws up to 1½"

THE BRISTOL COMPANY, Socket Screw Division, Waterbury 20, Conn.

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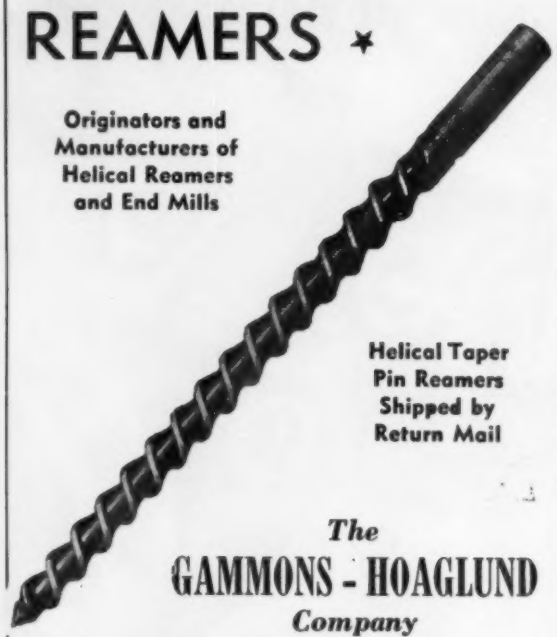
GAMMONS REAMERS *

Originators and Manufacturers of Helical Reamers and End Mills



Helical Taper Pin Reamers Shipped by Return Mail

The GAMMONS - HOAGLUND *Company*

400 Main Street, Manchester, Conn.

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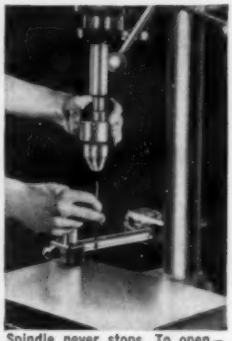
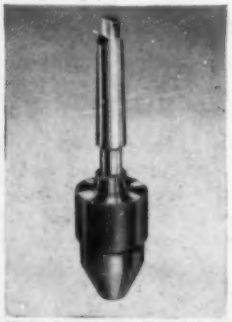


Spindle never stops. To open—pull down. Jaws open automatically, release tool. To close—insert new tool. It's locked and centered. The greater the load, the tighter grip.



Model A—capacities from ¼" to ¾" and ⅜" to ½" available with Nos. 1, 2 and 3 Morse Taper Shanks and Taper Adapters.

CHANGE TOOLS IN SECONDS, SAFELY!

Drill, ream, counterbore with one spindle, without stopping spindle or moving work.

No keys, collets or wrenches are needed on Wahlstrom Fully Automatic Chucks and Tapping Attachments. Tool is automatically centered. Grip can't slip or chew tool shank. Wahlstrom Chucks convert 95% of lost tool changing time to productive time. And, a single Wahlstrom Chuck does the work of several spindles. Write for spec. folder and distributor name. Wahlstrom Chucks—made by the makers of the Float-Lock Industrial Vise.

Another AMF Product

WAHLSTROM AUTOMATIC CHUCKS

AMF TOOL DIVISION
AMERICAN MACHINE & FOUNDRY COMPANY
224 Glenwood Avenue, Bloomfield, New Jersey

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For an investment of less than $200. in Bellows Air Equipment–

LOOK WHAT HAPPENED!

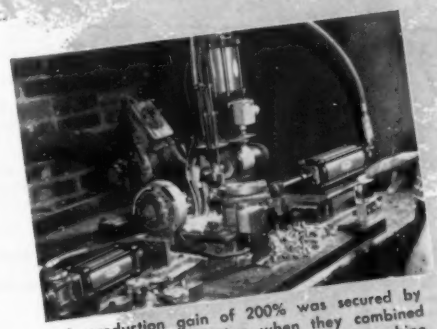
At the Formaid Co., makers of fine brassieres, Bellows Air Motors pre-crease interlining material, doing the job even better than a 5-ton punch press — with big reductions in spoilage, longer tool life, less set-up and much less down time.

Temple-Stuart Co., furniture manufacturers, teamed up two Bellows Air Motors and a Hydro-check for better than a 30% production gain in chucking wooden spindles, and as the operator put it — "at the end of eight hours I'm not tired at all."

Without heavy capital investment, substantial cost savings are being made in many operations with Bellows Air Motors and Bellows "packaged" work units: tool feeds, work feeders, holding devices.

These versatile units are being used to quickly convert standard machines to semi-automatic or automatic operation; or as basic components around which to build inexpensive special purpose machines.

More than 125 full-time Bellows Field Engineers (one or more in every major industrial area in the United States and Canada) are at your call to help your production men work out effective and low cost ways to use "Controlled-Air-Power."



A production gain of 200% was secured by Eastman Manufacturing when they combined three Bellows Air Motors in a special machine to mill and drill bakelite breaker arms. This set-up is one of 25 Bellows installations in the Eastman Plant.

Write today for these interesting free bulletins

Whatever you make, Bulletins ML-3 and BM-25 will make worth while reading for you and every member of your production staff. Address Dept. TE-1056.

Drilling a fly wheel counterweight is being done at R. C. Phelon Co. three times as fast with a Bellows Drill Press Feed and Air Vise as it could be done by hand. And the unskilled operator works with minimum fatigue.

The Bellows Co.

AKRON 9, OHIO

In Canada:

Bellows Pneumatic Devices of Canada, Ltd., Toronto, Ontario

620B-1

"Why is it easy to plan Hydraulic Circuits using RIVETT VALVES?"

COMPLETE LINE

Hand, Foot, Cam, Solenoid, Pilot Operated

Sub-Plate Mounted, Solenoid, Pilot Operated

Flow Control, Check, Deceleration, Relief, Unloading, Sequence, Counter-Balance

1500-3000 P.S.I. | PISTON DESIGNS FOR ANY CIRCUIT

Sizes: 1/4", 3/8", 1/2", 3/4", 1", 1-1/4", 1-1/2"

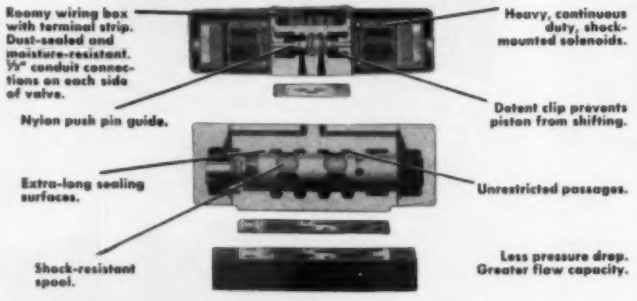
Actions: Standard, Spring Return, Spring Centered, Ball Detent

EXPERIENCED DISTRIBUTORS

"1st — Rivett's 190 standard models give me more latitude in engineering a circuit. This wide selection permits choosing the right type of valve for a more economical and efficient operation."

"2nd — My Rivett Distributor is experienced in hydraulic design. With his help I have been able to plan better operating systems."

QUALITY CONSTRUCTION


Roomy wiring box with terminal strip. Dust-sealed and moisture-resistant. ½" conduit connections on each side of valve.
Heavy, continuous duty, shock-mounted solenoids.
Nylon push pin guide.
Detent clip prevents piston from shifting.
Extra-long sealing surfaces.
Unrestricted passages.
Shock-resistant spool.
Less pressure drop. Greater flow capacity.

Sub-Plate Mounted, Solenoid, Pilot Operated Valve

INFORMATIVE LITERATURE

"3rd — I can count on longer life as well as the rated performance of Rivett Valves. They are designed and built for accurate circuit control."

"4th — Rivett valve catalogs are complete with specifications and drawings. Write for #204 and #260."

RIVETT LATHE & GRINDER, INC., DEPT. TE-10, BRIGHTON 35, BOSTON, MASSACHUSETTS

RIVETT furnishes a complete power package

AIR AND HYDRAULIC — VALVES, CYLINDERS, POWER UNITS

You can't beat this band!

Interested in faster cuts? smoother finish? less over-heating and breakage? The Atkins Curled-Chip Buttress Tooth band saw gives you all that and more! You get clean cuts—faster and smoother cuts . . . the "curled chips" roll easily out of the gullet—no jamming.

See your Atkins distributor today . . . increase production tomorrow . . . with Atkins!

ATKINS Silver Steel SAWS

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ACCURACY .0002 T.I.R.

.0002 T.I.R. OR LESS AT SPINDLE NOSE, .0005 T.I.R. OR LESS ON TEST ARBOR SIX INCHES FROM SPINDLE NOSE

SPINDLE SPEEDS 150 and 250 RPM Other Spindle Speed Pulleys Available

MODEL B943 MOTOR DRIVEN WORK HEAD

No. 11 B & S Tapered Spindle Standard Equipment. No. 12 B & S or No. 5 Morse Available at Slight Extra Cost.

The B943 Motor Driven Work Head is a compact self-contained power unit for internal and external grinding. It is held in position by two T-slot bolts and can be mounted at any convenient spot on the table. The swivel base, which is graduated 90° one side of center and 45° on the other, permits the Work Head to swivel full 360° if desired. Swivel base can be easily removed from head permitting units to be mounted on table without base if desired. The B943 is easily and quickly mounted on other makes of grinders.

The No. 11 B & S tapered spindle, mounted on ball bearings, is hardened and ground, and is designed to receive chucks, collet fixtures, face plates, straight or tapered sleeves, centers and like equipment. Unit is grease packed at factory and requires no service in the field for the life of the bearings. Streamlined in design, this fixture is quickly mounted and is easy for the operator to keep clean.

The special motor is provided with conveniently located reversing switch which is handy for the operator regardless of the position of the work table or rotation of the work. Motor operates quietly and is fully protected from dust and from any oil entering from working parts.

See this extremely accurate B943 work head at your equipment dealer or write for complete literature.

K. O. LEE COMPANY

ABERDEEN, SOUTH DAKOTA

USE READER SERVICE CARD; INDICATE A-10-252-1

Drill Hardened Steels without Annealing—

With the new, improved "HARDSTEEL" Drill, you can do accurate, smooth drilling, countersinking, counterboring and reaming in steels hardened by any process without first annealing the work. And they work with equal ease on work-hardening steels and high carbon—high chrome steels of any degree of hardness.

"HARDSTEEL" Drills fit standard drill presses. They save time and reduce rejects. They permit engineering changes requiring additional drilling after hardening. And parts drilled after hardening always match at assembly.

Write for a copy of the "HARDSTEEL" Operators Manual showing how "HARDSTEEL" drills are cutting costs in thousands of plants.

You Harden It—We'll Drill It—
With "HARDSTEEL"

BLACK DRILL COMPANY, INC.

1414 East 222nd St. • Cleveland 17, Ohio

"HARDSTEEL"

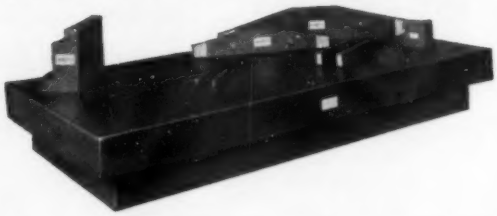
USE READER SERVICE CARD; INDICATE A-10-252-2

COLLINS

MICROFLAT®

BLACK GRANITE

- SURFACE PLATES
- ANGLE PLATES
- STRAIGHT EDGES
- LAYOUT PLATES
- PARALLELS
- T-SLOTTED PLATES



COLLINS MICROFLAT surface plates and precision accessories offer the user life-time accuracy at a minimum cost

All sizes—Write for bulletins.

- ☐ FREE Souvenir Paper Weight
- ☐ Microflat Technical Manual
- ☐ How To Calibrate Plates
- ☐ Gray, Pink, Black Granite Compared

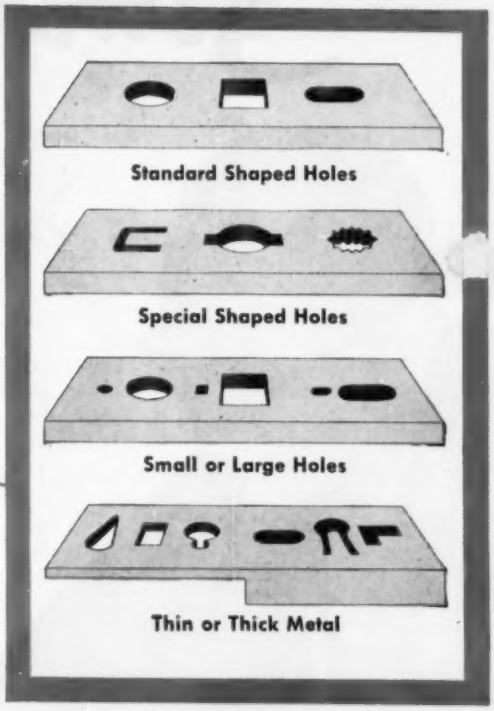
CHECK DESIRED ITEMS AND MAIL WITH YOUR NAME & ADDRESS

COLLINS MICROFLAT COMPANY, INC.

2326 E. 8th St. Los Angeles 21, Calif.

USE READER SERVICE CARD; INDICATE A-10-252-3

WHEN R-B Punches Are Used



What are your piercing or forming requirements—standard or unusual shapes—small or large holes—steel or special alloys—thin or thick metals? Many hole-making applications, formerly requiring drilling or some other costly means, can now be done with R-B interchangeable punches. If you have thought your piercing jobs too tough for interchangeable punches, it will pay you to investigate the wide application potential of R-B standardized equipment.

No other manufacturer of punches and die buttons can offer you the amount of successful application experience and the scope of knowledge that is available from the R-B engineering staff for:

★ Cutting Your Production Costs

★ Reducing Die Designing Time

★ Increasing Productivity of Presses

★ Supplying Answers to Piercing Problems

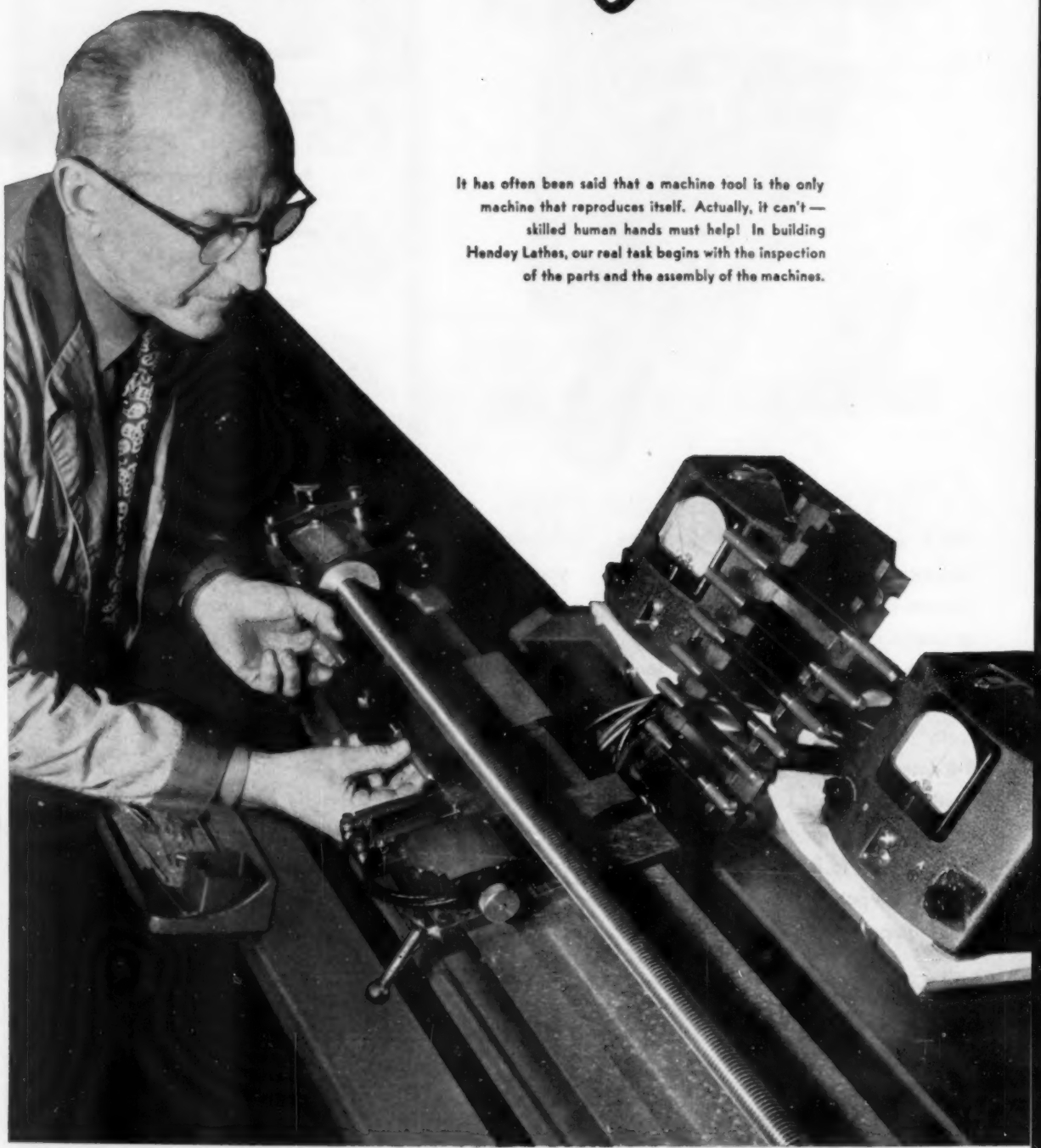
★ Saving Die Construction Time

★ Complete Standardization of Press Tooling

For Additional Information or Engineering Service, Write to:

RICHARD BROTHERS PUNCH DIVISION
ALLIED PRODUCTS CORPORATION
DEPT. 86 • 26490 CAPITOL AVENUE • DETROIT 39, MICHIGAN

Something more



It has often been said that a machine tool is the only machine that reproduces itself. Actually, it can't — skilled human hands must help! In building Hendey Lathes, our real task begins with the inspection of the parts and the assembly of the machines.

than tolerances...

creates the enduring accuracy built into

every *Hendey* Lathe!

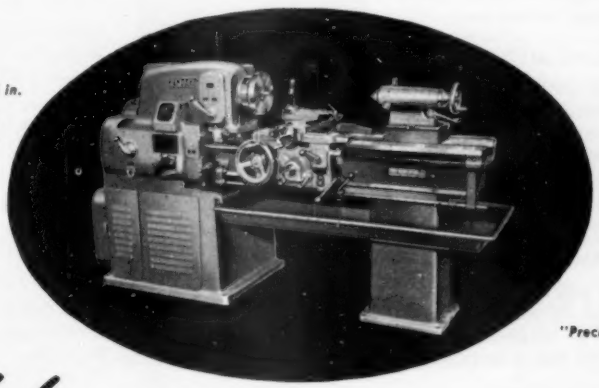
At the left you see one of our inspectors carefully checking a Hendey lead screw, assuring that it is within the prescribed tolerances. Every lead screw is cut to closest possible tolerances, and inspected with an electronic lead checker.

Every inch of every lead screw is checked with measuring rods and the special device shown. Two electronic gauges are used in this inspection — one to measure errors to within .0001 in., and the other to assure the operator that his setup remains the same from test to test. This method of inspection, re-enforced by the operator's desire for perfection, insures that lead screws are well within the lead tolerance over their entire length.

Our Model 2E General Purpose Lathe offers a fast, accurate method for cutting threads, as well as performing a variety of other toolroom operations. With a single, three-position lever on the apron, you can control the sequence of operations in thread cutting — starting, stopping, and reversing the tool through the thread without crossing it. For longer threads, half nuts and the thread chasing dial can be used.

For other operations, the Model 2E Electronic Drive gives you infinitely variable spindle speeds from 15 to 1500 rpm. On facing cuts, stepped diameters, and tapers, the operator can change speeds during the cut, selecting the correct rpm on the control rheostat. The belt drive provides smooth vibration-free power to the spindle for extra-fine finishes, and back gears are provided for heavier cuts. These and other Hendey features mean easier, low-cost production and faster "pay-off" on your investment. Write your Hendey dealer for complete facts!

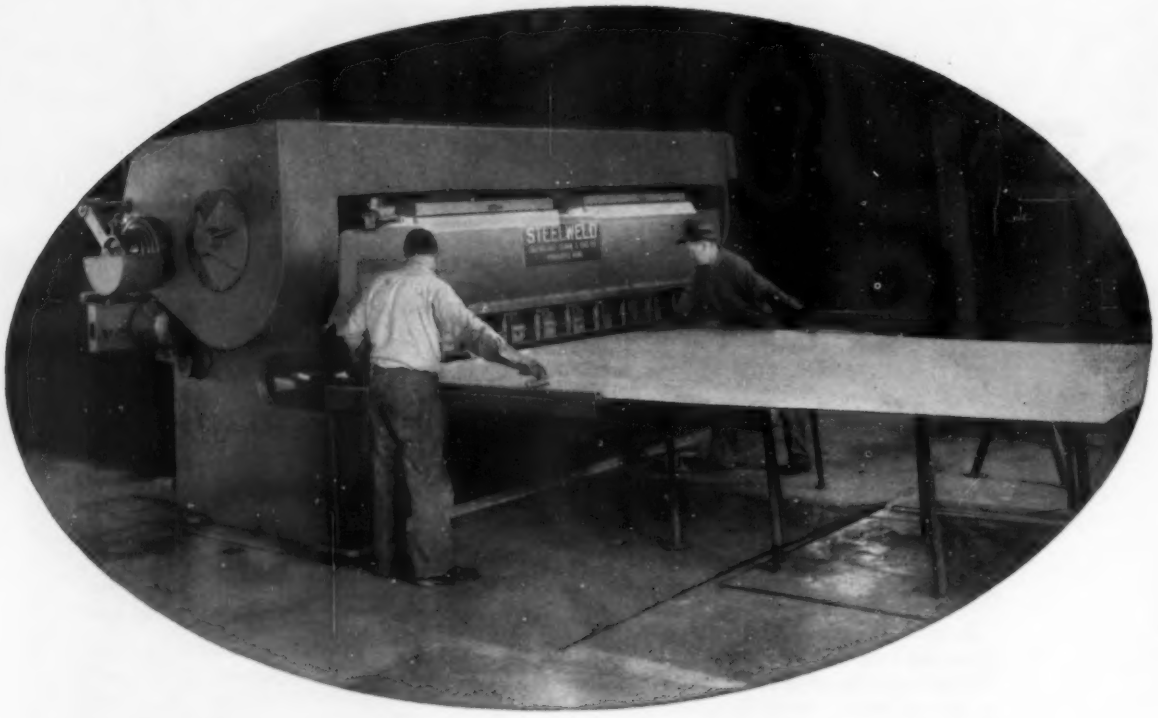
Hendey No. 2E 14 in.
General Purpose Lathe



"Precision with Production"

Hendey **machine division**
BARBER-COLMAN COMPANY
103 LOOMIS ST., ROCKFORD, ILLINOIS

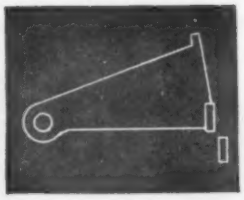
BARBER COLMAN ®



PIVOTED-BLADE MAKES SHEARING

Fast . . Easy . . Accurate

Because of the pivoted-blade design, Steelweld Shears have several outstanding advantages which make shearing fast, easy, accurate:



EASY KNIFE ADJUSTMENT

A direct result of this design is the easy knife adjustment it makes possible. Knife clearance is quickly made to suit every plate thickness by simply turning a crank until the pointer on an indicator is set for the metal to be cut. No bolts to loosen; no parts to move.

ELECTRIC FOOT CONTROL

The electric foot switch is a great convenience which is standard on all Steelwelds. It can be slid around floor to wherever easiest to reach. Only a touch of the toe is required to operate it.

ALL-WELDED ONE-PIECE FRAME

Only because of the pivoted-blade design, was it possible to weld all parts of the frame into one solid integral unit. As there is no need of moving the bed to adjust for knife clearance, it, too, is welded permanently to the end housings. Since there are no bolted connections to loosen and misalign, deflections are minimized and long-time accuracy assured.

MANY MORE IMPORTANT FEATURES

These are a few of the features. There are many more. When you get the facts you will agree that no other shears compare with Steelwelds. Write for catalog No. 2011.

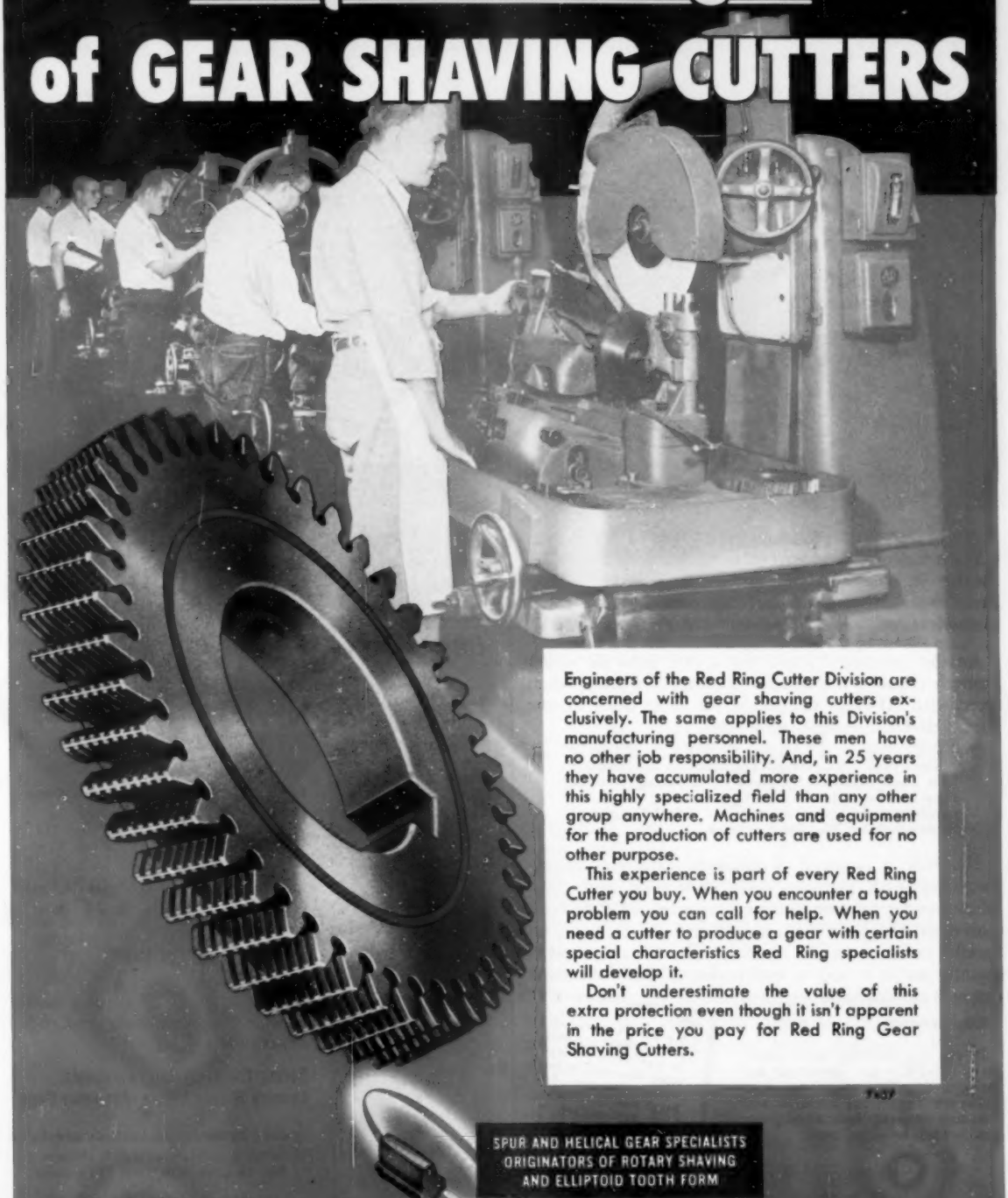
GET THIS BOOK!

CATALOG No. 2011 gives construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.
8513 East 282 Street, Wickliffe, Ohio

STEELWELD PIVOTED BLADE SHEARS

A Tip to the Buyer of GEAR SHAVING CUTTERS



Engineers of the Red Ring Cutter Division are concerned with gear shaving cutters exclusively. The same applies to this Division's manufacturing personnel. These men have no other job responsibility. And, in 25 years they have accumulated more experience in this highly specialized field than any other group anywhere. Machines and equipment for the production of cutters are used for no other purpose.

This experience is part of every Red Ring Cutter you buy. When you encounter a tough problem you can call for help. When you need a cutter to produce a gear with certain special characteristics Red Ring specialists will develop it.

Don't underestimate the value of this extra protection even though it isn't apparent in the price you pay for Red Ring Gear Shaving Cutters.

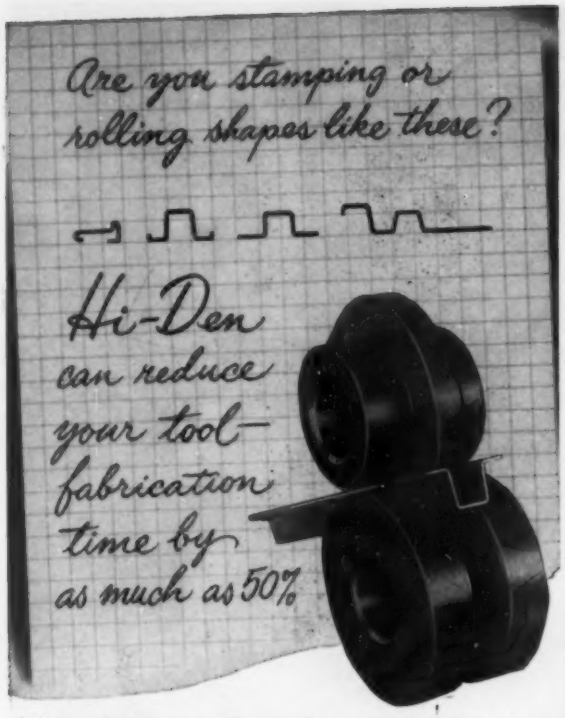
SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING
AND ELLIPTOID TOOTH FORM

NATIONAL BROACH & MACHINE CO.

5609 ST. JEAN • DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-257



A large aircraft manufacturer* reports HI-DEN rolls in a Yoder machine produced these short-run parts in stock sheared from sheet aluminum (in as-quenched condition) more satisfactorily and economically than other methods tested. And *tool fabrication time was reduced* 50%.

Another company* found that a steel draw die which formerly required three passes to complete a draw, when faced with HI-DEN completed the same draw in one pass. HI-DEN *treats the metal better.*

More than 100 different applications for HI-DEN have been reported by users . . . forming, stretch, draw and press brake dies; jigs, fixtures, templates, pressure pads and many others. Ideal for use in Hydro-form or Mar-form presses.

HI-DEN, a compreg of selected wood veneers impregnated with phenolic resin (laminated and compressed under extreme heat and pressure) is far stronger than equal weight in steel, is lighter in weight, easier to handle, resistant to oil, alcohol and moisture, dimensionally stable — and is easily shaped with standard tungsten carbide tools.

**Names on request*

If you are forming light metal parts, HI-DEN has important advantages to offer. Why not send today for Technical Bulletin and literature showing how to improve quality while lowering costs?

PS. HI-DEN's companion product, Parkwood 8000 (a kraft paper impregnated laminate) is becoming popular for bench tops . . . smooth, hard, but resilient, it won't burr and scratch assemblies of aluminum alloy and other softer metals.

Parkwood Laminates, INC.
32 Water St., Wakefield, Massachusetts

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WORLD'S HARDEST METAL

● New, improved TALIDE METAL is uniform in quality—gives top performance on ALL cutting, drawing and wear-resistant applications. Write for Catalog 58-G. METAL CARBIDES CORP., Youngstown 12, Ohio.

USE READER SERVICE CARD; INDICATE A-10-258-2

Look into the complete, cost-cutting* LOVEJOY *line. Standard tools are in stock – to help you increase production, save time and money now!

INSERTED-TOOTH MILLING CUTTERS

Face, side, end, slotting and boring mills.

H. S. S., CARBIDE, ALLOY BLADES

Interchangeable in all Type "A" milling cutters from 4½" to 24" in diameter.

NEW! SET-SCREW TYPE END MILLS

And new Type "Z" slotting cutters provide maximum axial and radial adjustment.

Boring Tools • Arbors • Flywheels
Lovejoy Milling Cutter • Assembly Gage

Special cutters are a Lovejoy specialty

Write for new catalogs: No. 31 (Face Mills), No. 32 (Side Mills), No. 33 (Arbors).

131 MAIN ST., SPRINGFIELD, VERMONT

Send for free **SPEED & FEED CALCULATOR**

LOVEJOY TOOL COMPANY, INC. Ltc
SPRINGFIELD, VERMONT, U. S. A.

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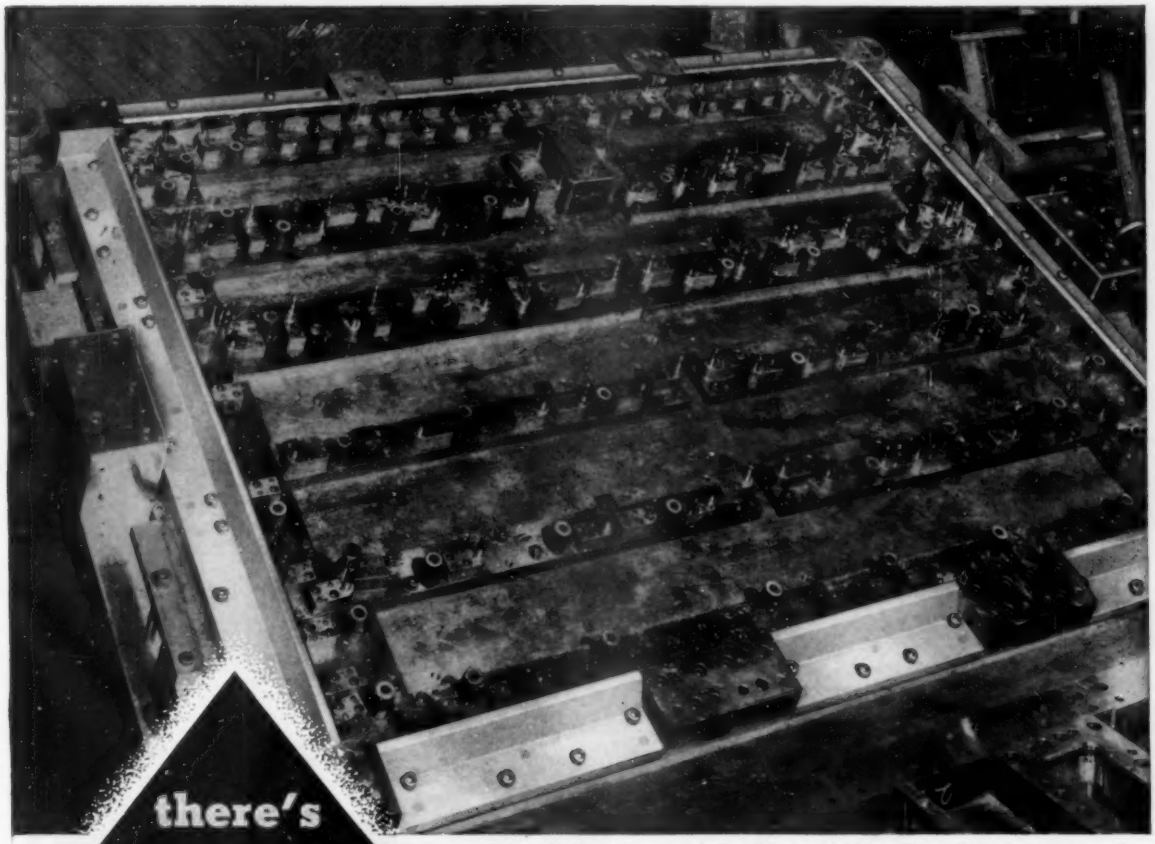
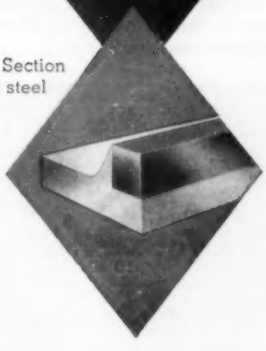


Photograph courtesy of the Ready Machine Tool & Die Company, Inc., Connersville, Ind. shows Ohio Knife Co. Composite Die Sections on a blank and pierce die for a 4' x 6' refrigerator inner food compartment.

there's a NEW way to build your dies



OK Die Section shows tool steel clad to mild steel backing.

it saves you time and money

You simply order from our large stock of Composite Die Sections. They are cut to your required length or in bars 125" long. There are eleven standard cross sections with both wide and narrow lands available.

You buy them at a price far below what it's costing you to make them yourself.

You receive them with cutting or forming edge already hardened, machined and ground. The soft steel backing, to which our specially hardened tool steel is clad, can be drilled quickly and economically for dowel and screw holes. Adjustments for wear are equally simple.

Hundreds of companies who have switched to OK Composite Die Sections available for Cutting, Trimming and Forming Dies, report great time and money savings, plus longer die life. For new bulletin on OK Composite Die Sections and Clad Aluminum Bronze Wear Plates, write Dept. 47-U.

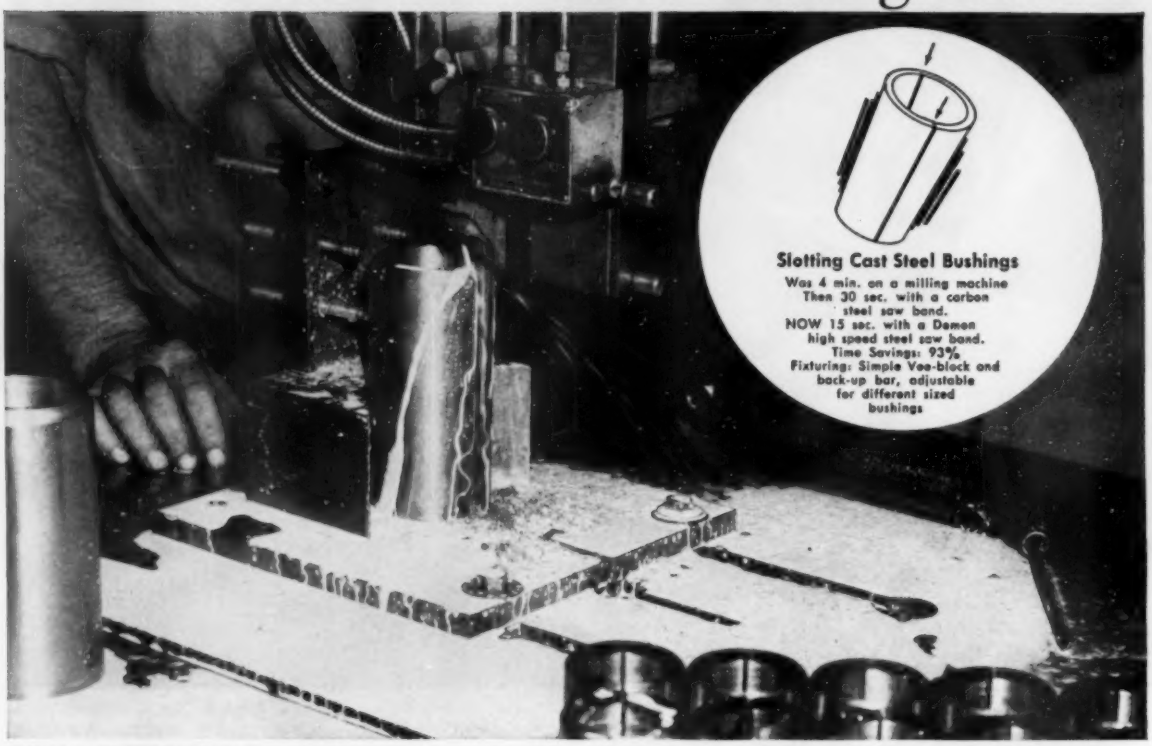
Manufacturers
for the Metal Working Industry of:

Composite Die Sections . Bronze Ways . Wear Strips
Shear Blades . Slitter Knives . Work-Rest Blades
Cut-off Blades . Hardened Ways . Hardened Spacers

THE OHIO KNIFE CO.

CINCINNATI 23, OHIO

How Production Band Machining Cuts Slotting Costs



Slotting Cast Steel Bushings

Was 4 min. on a milling machine
Then 30 sec. with a carbon steel saw band.
NOW 15 sec. with a Demon high speed steel saw band.
Time Savings: 93%
Fixturing: Simple Vee-block and back-up bar, adjustable for different sized bushings

Slotting Clamp Brackets

Was 2.5 min. on a milling machine
Then 30 sec. with a carbon steel saw band
NOW 20 sec. with a Demon high speed steel saw band.
Time Savings: 86%
Fixturing: Simple back-up bar.

New DoALL Contour-matic

Hydraulic feed table, integral coolant system, tilting table, infinitely variable speed and feed, high horse power, greater rigidity . . . has more, does more than any other band machine made.

Up to 93% Time Savings

Production slotting, both short and long runs, with a DoALL Contour-matic and Demon saw bands, has proved in every instance, many times faster than other methods.

Typical time savings range from 30% to 90%, with the following bonus benefits:

Lower Initial Cost. Contour-matic band machines with power feed tables and accessories that adapt them to a broad range of work often cost as little as ½ as much as slower single-purpose machines.

Lower Fixturing Cost. Downward thrust of saw band forces work against table, eliminating high-priced work hold fixtures. In most cases, a simple back-up bar is all that is needed.

Greater Machining Versatility. The DoALL makes straight or contour cuts . . . and it will grind, polish, slice or file on a production basis, too.

Fixture Service. A complete fixture service for production work is available —including design, time study and fixture manufacture.

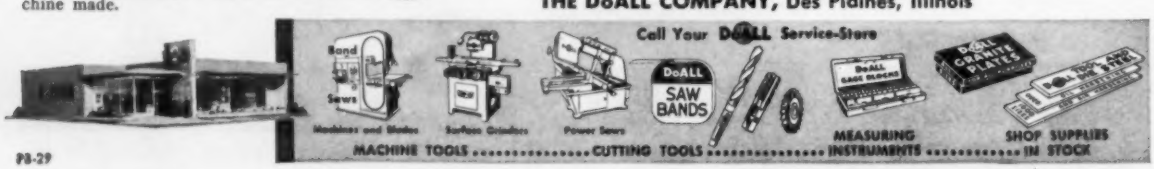
Free Literature. Catalogs of DoALL Contour-matic band machines are available — write for them.

Free Movies. Sound color— "Production Band Machining," 30 min., "Production Tooling," 10 min.

DoALL

Free In-Your-Plant Demonstration. Call your local DoALL Sales-Service Store or write:

THE DoALL COMPANY, Des Plaines, Illinois



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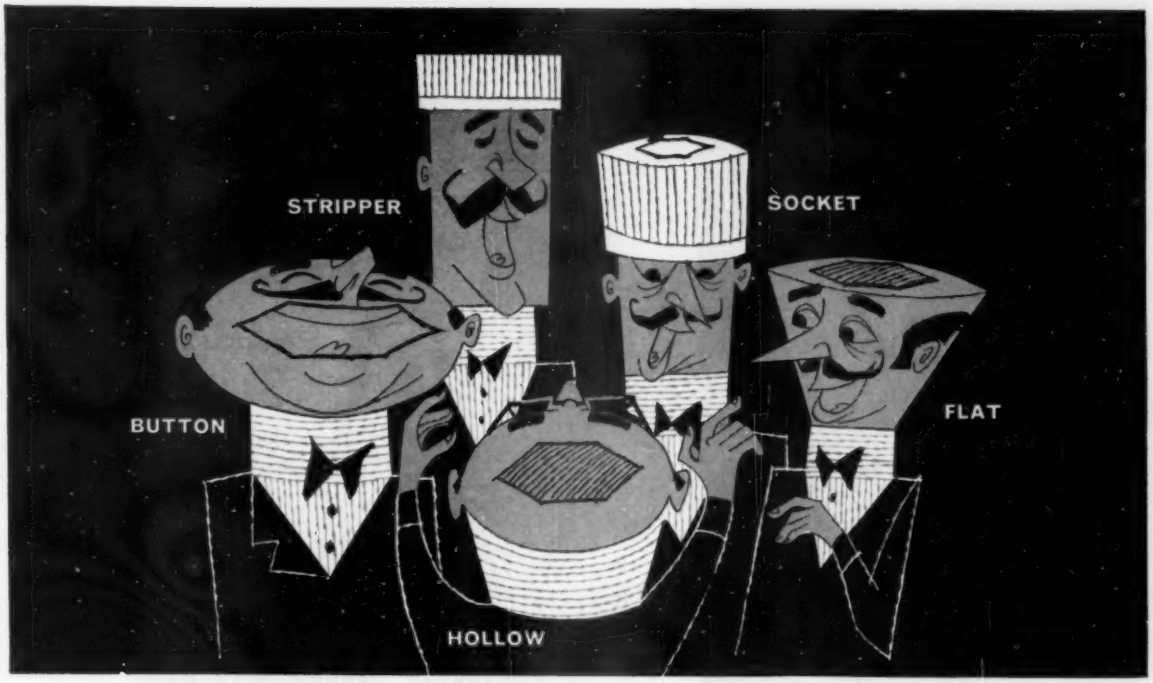


Socket Screws of all kinds

FOR TOOLING OR PRODUCTION

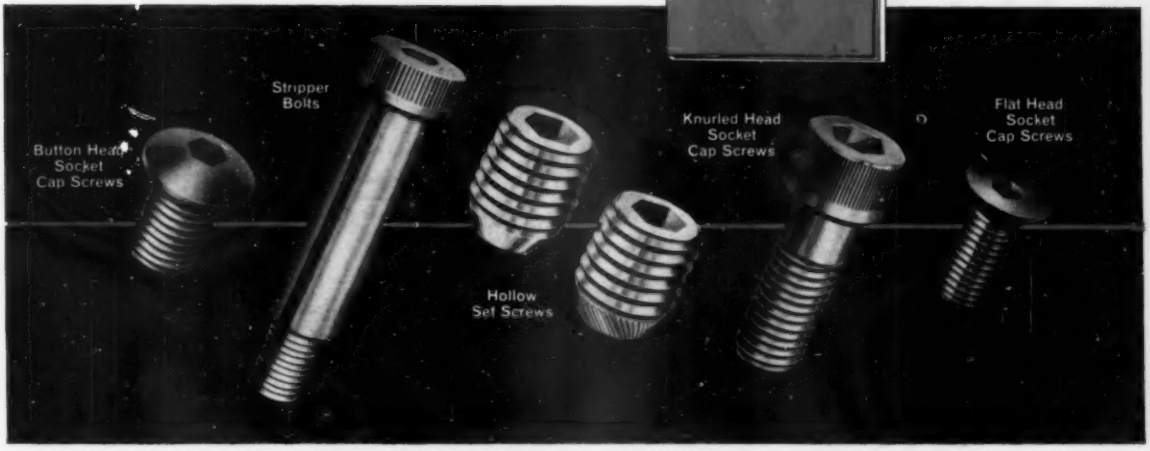
The precision screws you need for tool room use, maintenance, diemaking or production—in the head style, size and thread you want—are available quickly from Danly branch or distributor stock or in bulk quantities for factory shipment. Danly's screw line offers the convenient, complete answer to your standard screw requirements, from No. 4 to big 2" diameter socket head cap screws. You can be sure, too, of dependable quality every time.

Available from stock at leading industrial distributors and Danly branch assembly plants in all major toolmaking centers.

Danly Machine Specialties, Inc., 2100 South Laramie Avenue, Chicago 50, Illinois.

DANLY®

Write for your copy of our complete catalog of diemakers' supplies and bolster plate accessories . . . lists every supply item generally needed in die shop, tool room or press room.


Button Head Socket Cap Screws
Stripper Bolts
Hollow Set Screws
Knurled Head Socket Cap Screws
Flat Head Socket Cap Screws

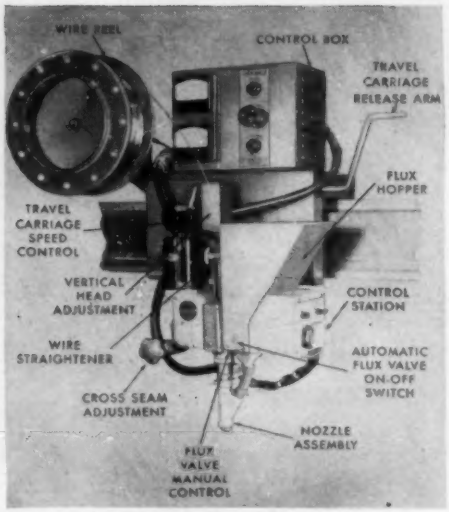
When a line of automatic welders for DC and AC operation

Has the most sensitive controls for fast starting and uniform welds

Yet is easiest to adapt to any fixture

WHY

buy anything but LINCOLNWELD for automatic welding



New automatic

LINCOLNWELD

simplifies tooling

...increases production dependability

LAF-3 Lincolnweld for DC welding
LAF-4 Lincolnweld for AC welding

Universal, foolproof controls give you . . .

- **dependable starting . . . uniform quality welds**
- **cold starts or hot starts**
- **controllable inching speed**
- **simple accurate positioning**
- **integral or remote controls**

WRITE FOR Bulletin SB-1355 for complete specifications.

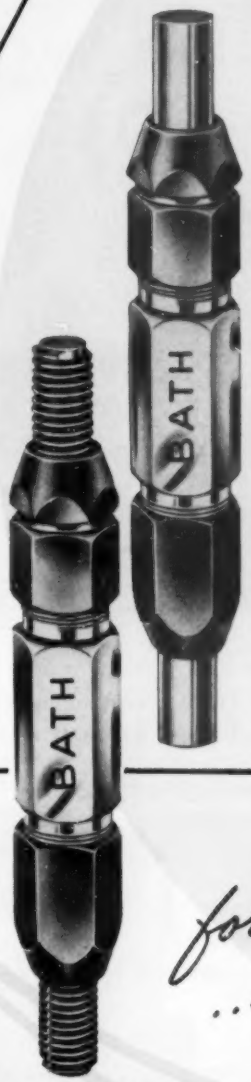
Longitudinal Welds *made at low cost on automobile rear end housings with LAF-3 Lincolnweld and simple fixture.*

Circular Welds *in welding cover to back face of banjo.*

THE LINCOLN ELECTRIC COMPANY
Dept. 5011, Cleveland 17, Ohio

LINCOLN . . . *one dependable source for all your arc welding needs— welders • power sources • fluxes • electrodes • application engineering.*

*Controlled Measure....



A roar . . . a flash . . . and away it goes! Another guided missile streaks into space, dependent on the performance of sensitive electronic equipment. Precision is vital . . . components must function without fail.

Bath Gages . . . tools of the science of **controlled measure* . . . are made to check the limits of these intricate parts . . . on the line and at inspection centers.

No matter how fussy the job . . . cylindrical plug or thread, ring or reversible type Bath Gages are designed for accuracy and long wear-life.

Remember . . . when you buy Bath Gages . . . you buy ***controlled measure*** for threaded and plain parts and holes.

for the best buy ...buy Bath

JOHN BATH & CO., Inc.
28 Grafton St., Worcester, Mass.
CYLINDRICAL AND THREAD GAGES • GROUND THREAD TAPS • INTERNAL MICROMETERS

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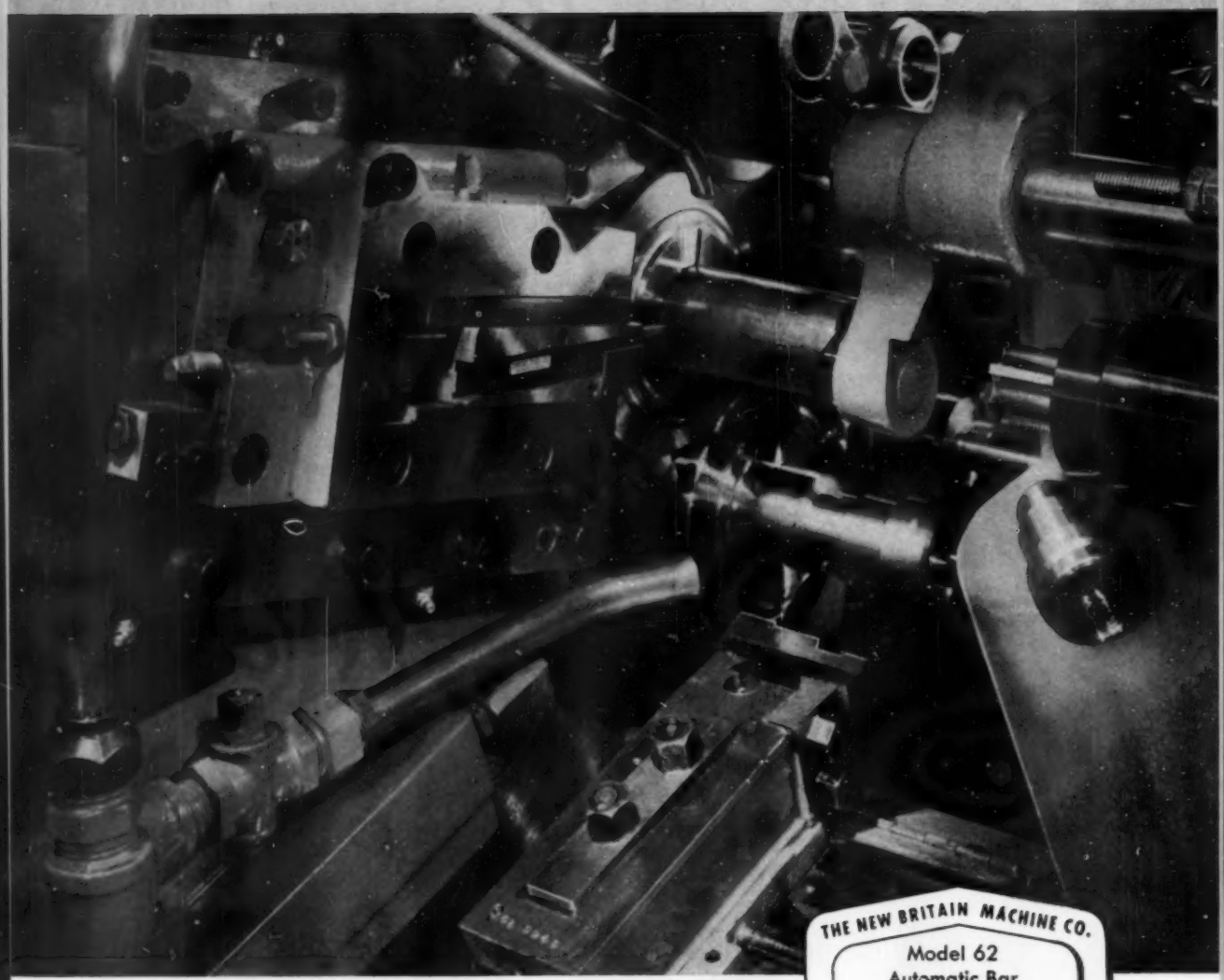


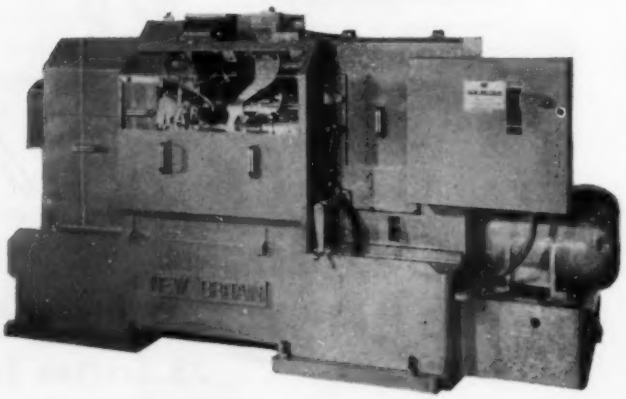
THE NEW BRITAIN MACHINE CO.

Model 62
Automatic Bar
Machine

NB

a rugged cross slide in every position

New Britain Models 60 and 61 Automatic Bar Machines are everywhere you turn. The new Model 62 represents new progress in rugged construction and versatility of setup. Your New Britain Representative can show you how to modernize at a profit. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.



There's a Standard **PUTNAM END MILL** *for Your Job!*

Universal Application of Putnam End Mills (there are over 1200 standard sizes and types) permits users to select a standard end mill specifically designed for each job.

Many standard Putnam End Mills are of a type considered "specials" by other manufacturers. Also, a wide range of sizes are available in every standard type of end mill to provide complete application coverage.

From smallest to largest sizes—from fine intricate machining to rugged milling operations there is probably a standard Putnam End Mill that will mill your job more efficiently. However, Putnam will also produce "special" end mills to your specs for those extra-special applications.

PUTNAM
TOOL COMPANY
2981 CHARLEVOIX AVE. • DETROIT 7, MICH.

Pangborn HYDRO-FINISH wet blasting saves $22,500 a year for Imperial Brass!

Pangborn Hydro-Finish wet blasting is used at Imperial Brass Mfg. Co., Chicago, to remove heat scale and carbon deposits from dies. Imperial Brass is highly gratified with results. Hydro-Finish does a perfect cleaning job and gives a smooth finish, with no breakdown of sharp edges or loss of tolerances. It has required no maintenance in its 1½ years of operation. And Hydro-Finish has cut time and labor costs so drastically that the firm saves $22,500 a year on this step alone!

If *you* clean dies and molds, you should investigate Pangborn Hydro-Finish . . . now offering even lower investment and more efficient operation by using air jet sluriators instead of a pump. Write today for Bulletin 1402 to PANGBORN CORPORATION, 4700 Pangborn Boulevard, Hagerstown, Maryland. *Manufacturers of Blast Cleaning and Dust Control Equipment.*

Pangborn

BLAST CLEANS CHEAPER

2H

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-266-1

HOGGSON STEEL HANDSTAMPS

for EVEN...
DEEP...
CLEANCUT...
LETTERS & FIGURES

Sharp, clean impressions even after years of use! Hoggson Brand Letters & Figures Hand Stamps will not spall or mushroom. Available for numbering or lettering anything from pig iron to jewelry. 19 sizes in stock, from ⅛" to 1". Roman or Gothic. Letters 27 pcs. per set; figures 9 pcs. per set.

See your distributor or send for complete catalog

HOGGSON & PETTIS MFG. CO.
144 Brewery Street, New Haven 7, Conn.

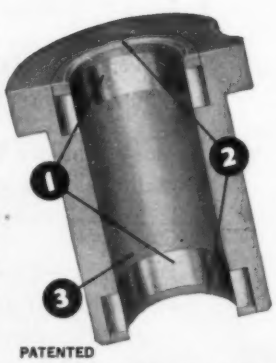
USE READER SERVICE CARD; INDICATE A-10-266-2

MEYCO CARBIDE INSERTED DRILL JIG BUSHINGS PROVE THEMSELVES *IN Automation!*

The reason is simple: these unique bushings are ideally suited for long-running, uninterrupted operations!

MEYCO carbide inserted bushings assure long life for drills, jigs, fixtures . . . accurate work maintained, resulting in less down-time, fewer lost man-hours. Last almost as long as solid carbide bushings, cost slightly more than ordinary bushings. Get the full story:

Write for information and price list, ask for Catalog No. 42



PATENTED

1. Tungsten carbide rings at the points of wear; 2. Steel rings protect drills and carbide; 3. Special hardened alloy steel body.

EST. 1888

W. F. MEYERS CO., INC., BEDFORD, INDIANA

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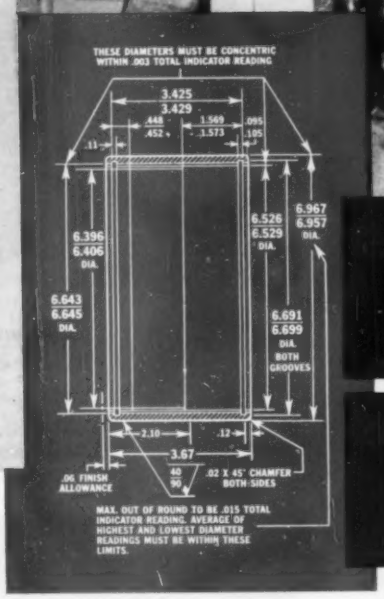
Automobile Manufacturer produces

Repetitive Pieces to Close Tolerances with

BULLARD MULT-AU-MATIC Type "L"

At one of the nation's largest automotive plants, a number of Bullard Mult-Au-Matics, Type "L" are employed to produce automatic transmission parts. According to the Process Engineer "The transmission is the most precision piece of equipment in the entire car — with many moving parts fabricated to close tolerances."



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horizontal optical jig borer

with 5 optical microscopes

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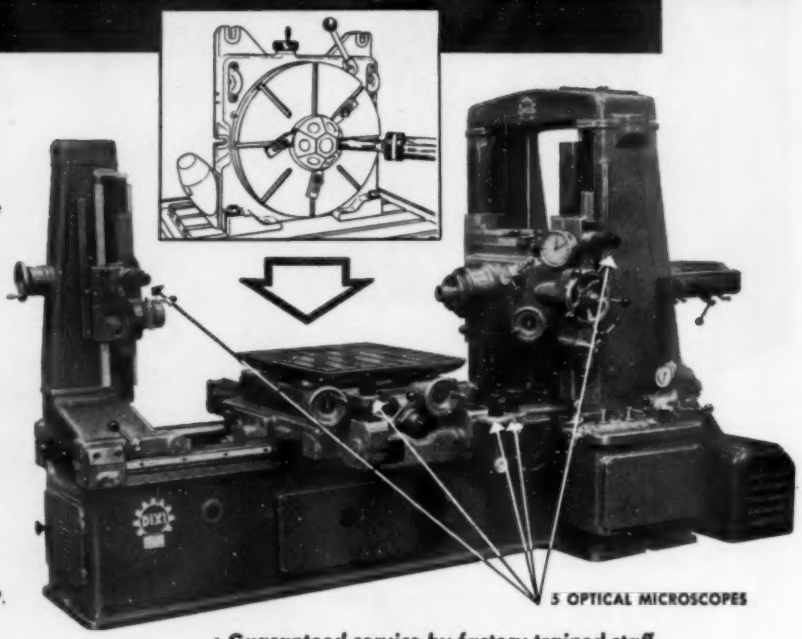
A precision machine for *JIGLESS* boring, facing, milling, and drilling work, in all planes. Built-in 360° optical rotary table, 28¾" x 32¾". All spindle and table settings by optical microscopes. Infinitely variable hydraulic feeds. Mechanical spindle feeds with automatic depth stop. #40 taper spindle-speeds infinitely variable to 1400 R.P.M. Special features eliminate effect of spindle overhang on accuracy.

DIXI 450 PRECISION OPTICAL CIRCULAR DIVIDING TABLE

Direct readings of 1 sec.

(See insert picture above) rigidly mounted (not tilting) on built-in rotary table permits holding close tolerance relations between bores in all planes, including bores at compound angles. ALL IN ONE SET-UP. All sides of the work piece except the mounting face machined in one set-up.



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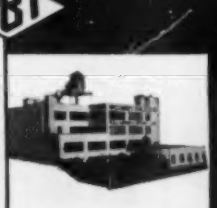

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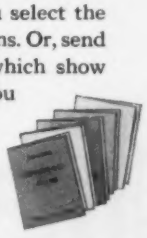

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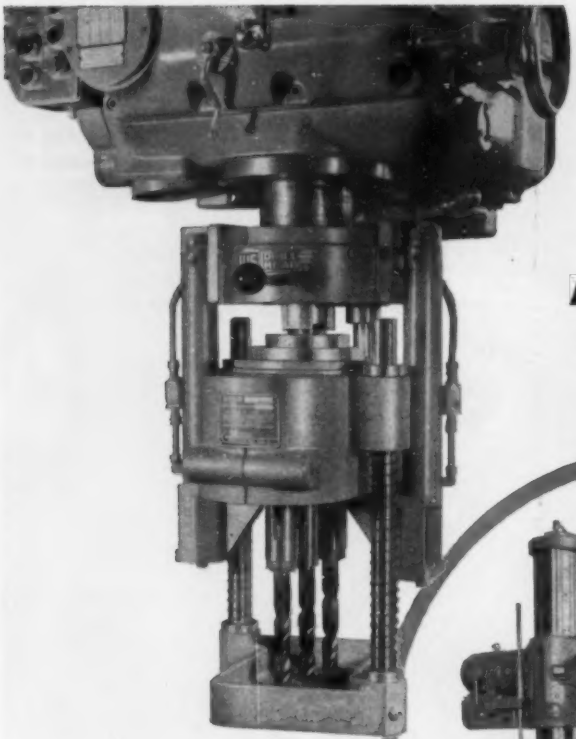
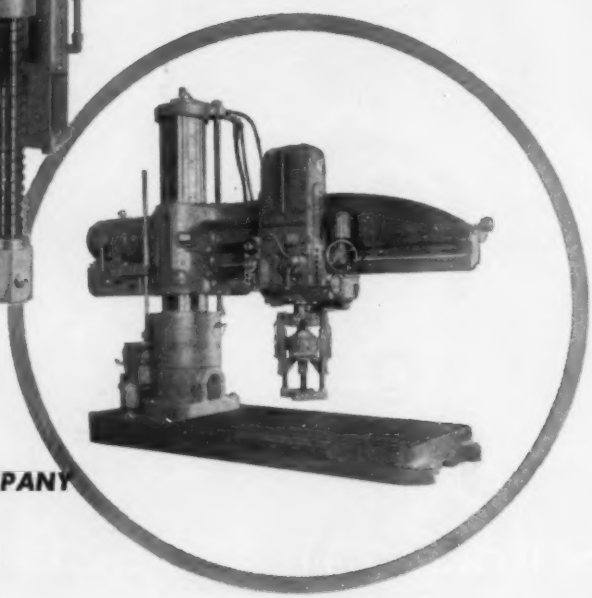


new

DRILL HEAD AIR COUNTERBALANCE SWIVEL ATTACHMENT

FOR RADIAL DRILLING MACHINES



THIS IS ANOTHER FIRST FOR THE U. S. DRILL HEAD COMPANY

This new combination Swivel and Air Counterbalance attachment makes it possible to adapt large multiple spindle drill and tapping heads to radial drilling machines.

Flexible and easily adjusted, it insures maximum safety for the operator, as well as better operating economy.

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This package is ideally suited for drilling condenser plates, boiler tube sheets, flue sheets, etc.

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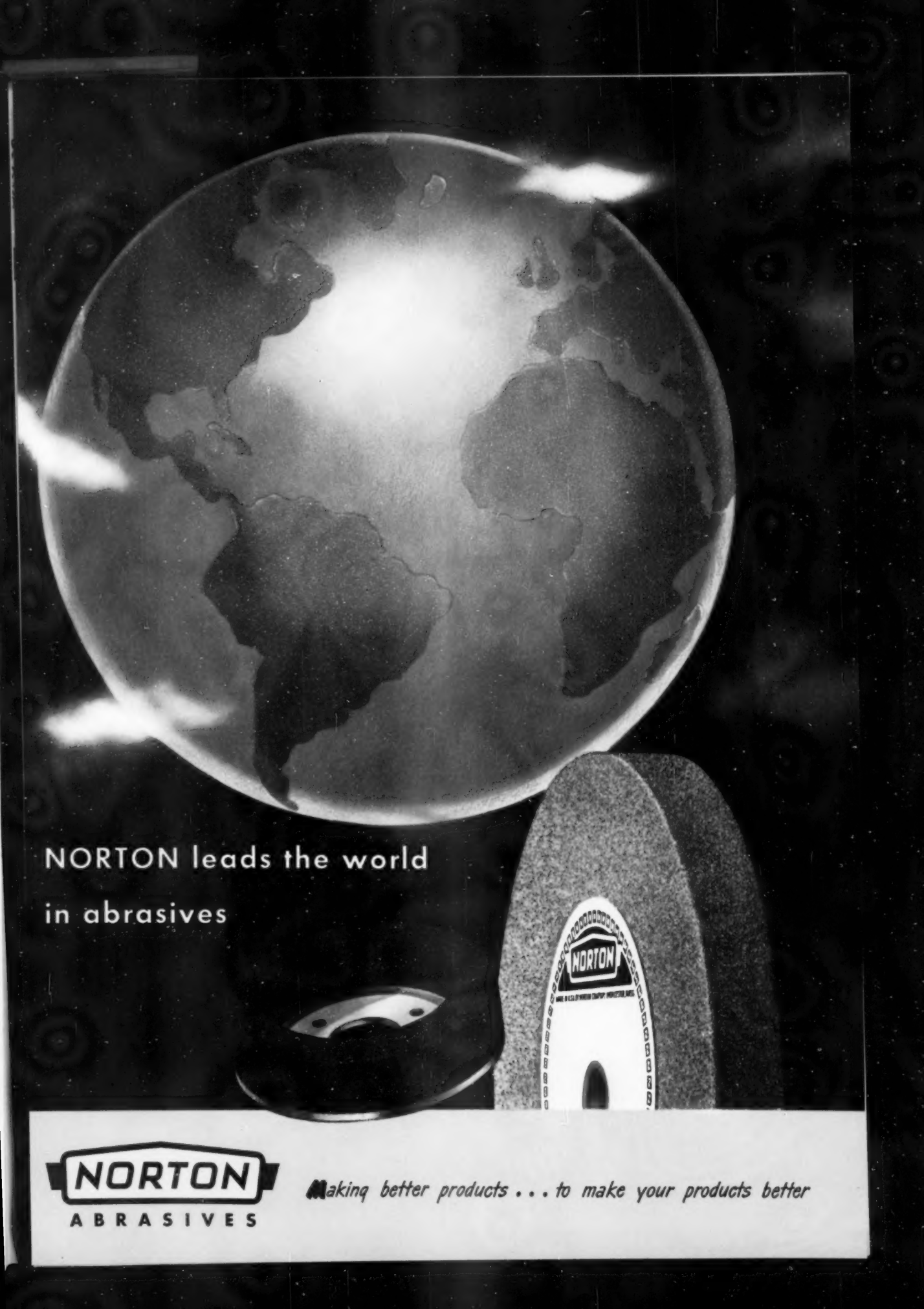
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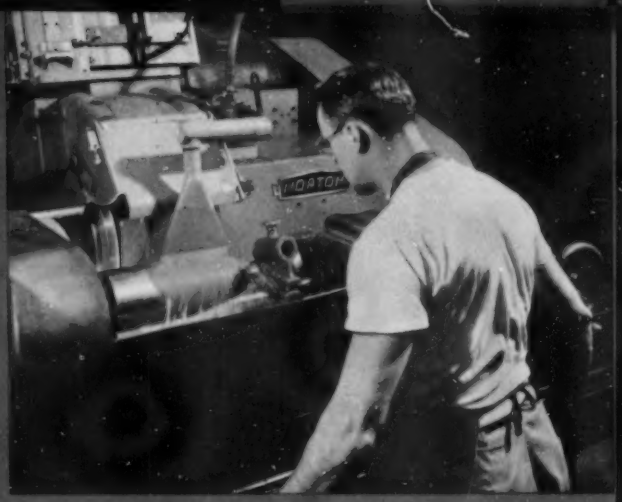
NORTON BRINGS THE "TOUCH of GOLD" TO GRINDING JOBS THE WORLD OVER



THE TRUE "TOUCH OF GOLD" in grinding can happen only when the grinding wheel — or other abrasive product — is doing the best possible job. That is, when it is saving the most time and money — adding the greatest value to the product being ground — and boosting grinding profits to the maximum. These are the benefits built into all Norton abrasives.

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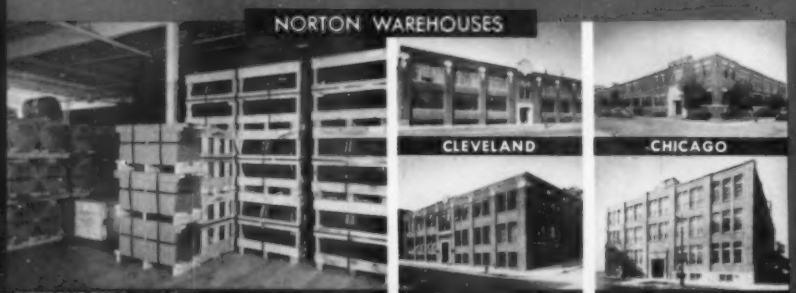
EACH NORTON PRODUCT is manufactured to strictest quality control standards. And each is backed by research and development that have produced the greatest number of abrasive advancements in the field. For example: 32 ALUNDUM* abrasive, unequalled for fast, cool cutting action on today's steels . . . G Bond, most efficient vitrified bond ever developed . . . and NORBIDE boron carbide, hardest material made by man on a commercial production basis.

YOUR NORTON DISTRIBUTOR is ready to help you on any grinding problem. His factory-trained specialist will see that you get exactly the right wheel for each job. And your Norton Abrasive Engineer is always available for expert technical consultation. Take advantage of these application aids to better, more profitable grinding.



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Tool Steel Topics

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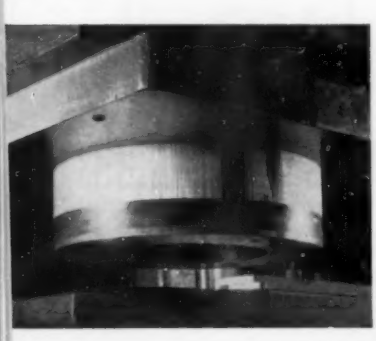
Good Results with BTR Hollow-Bar in Manufacture of Fan Housing

Based upon all-around performance — less time spent in machining, good resistance to wear, and ease of heat-treatment — dies of BTR (Bethlehem Tool Room) Hollow-Bar rang the bell recently at Electrolux Corp., Old Greenwich, Conn.; the steel was supplied by Lindquist Steels, Inc., Bridgeport, Conn.

The dies, hardened to approximately Rockwell C 60, and operating in a 100-ton press, formed fan housings from 25-gage zinc-coated sheet steel at the rate of more than 1600 pieces per hour. Redressing was required once every two months or so, and then no more than 0.010 in. was removed.



BTR Hollow-Bar is made from our oil-hardening tool steel by a process called high-speed trepanning. By this method, we take hammer-forged round bars, core the inside diameter, then give them a rough-turning on the outside.

With BTR Hollow-Bar there's no need to run up shop costs waiting for delivery of forged rings or discs. Instead, this fine tool steel comes to you ready to go, with no need for drilling, rough-boring, rough-facing or rough-turning.

Your Bethlehem tool-steel distributor will be glad to explain how BTR Hollow-Bar can be of real service to you. Or a phone call or letter to the nearest Bethlehem sales office will bring you detailed information promptly.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Remove all the "Bark" from Liquid-Quenched Tools

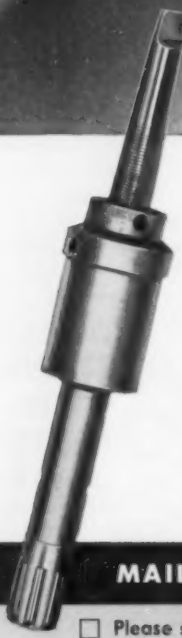
Most users of tool steel realize that it is necessary to remove the "bark" (scaled and decarburized outer surface) from tool-steel bars in order to obtain full, uniform hardness in heat-treatment. If this area is not removed, low hardness will result because of the low carbon content of the decarburized metal. It is not always recognized that this procedure is necessary on tools which are to be liquid quenched, even though portions of the tool do not constitute working surfaces.

If tools are to be liquid quenched, all the bark must be removed to avoid excessively high quenching stresses which could cause cracking of tools during hardening. Low carbon areas on the surface transform during hardening at a different time than the higher carbon interior. This sets up additional stress which, added to the high thermal stresses from quenching, could cause cracking. Air-hardened tools can tolerate bark on non-working areas because of the low hardening stresses in air hardening. But with liquid-quenched tools there are no exceptions — remove all the bark.

"Teamwork," Bethlehem's new motion picture on tool steel, received a second film award, a silver reel symbolic of excellence, at the recent American Film Assembly competition in Chicago.

The 16-mm, 30-minute color film explains the manufacture, quality control and heat-treatment of Bethlehem tool steels. It is available for showings to machinists, heat-treaters, die makers and tool manufacturers. To see the film, write to Publications Department, Bethlehem Steel Company, Bethlehem, Pa.

Greatest thing that's happened since the Madison Boring Tool!



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No wonder a customer said it's "the greatest thing since the Madison Boring Tool!" If you'd like to know more about this fabulous tool, or our roller-burnishing tools for O.D. cylindrical surfaces as well as tapers and radii, just send coupon today.

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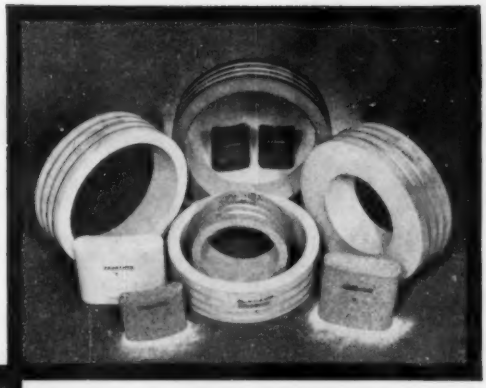
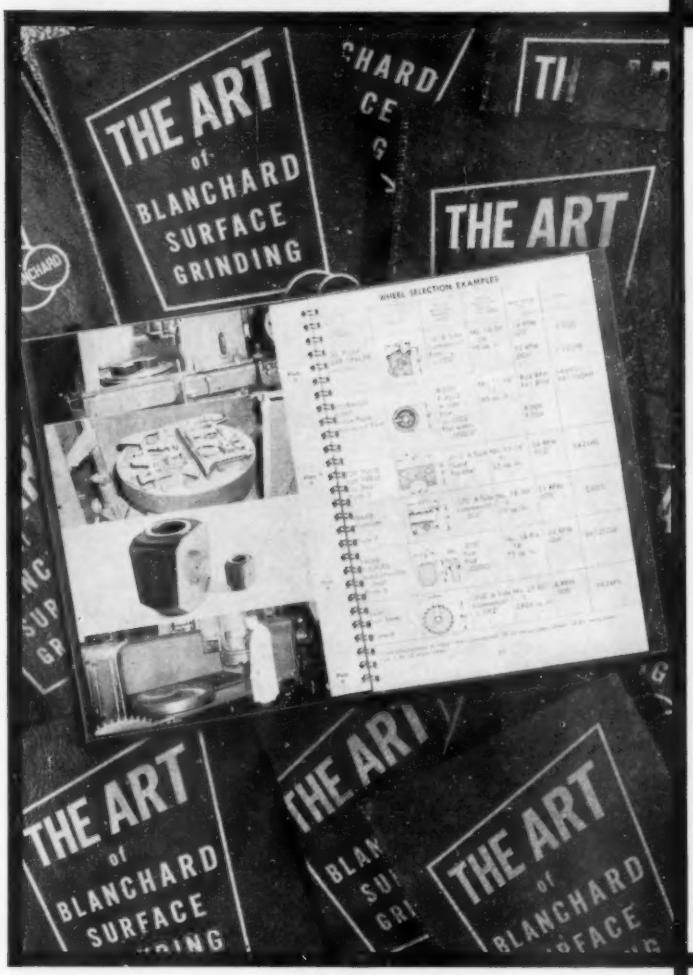
Page after page shows the correct abrasive wheel to use

(for the best Blanchard grinding results)



Blanchard wheels in silicate, resinoid and vitrified bonds.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This is our famous booklet *The Art of Blanchard Surface Grinding* — brought up-to-date with a third edition. It contains complete descriptions of our silicate, resinoid and vitrified bonded wheels. It also describes a number of jobs and shows you how to select the correct wheel for each job. Every Blanchard operator should have a copy handy — send for yours today.

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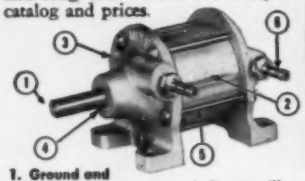

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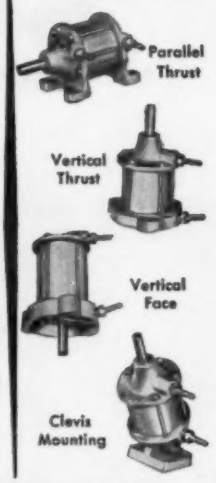

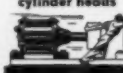

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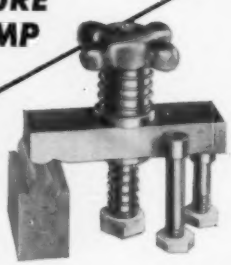
New SWINGLOCK One-Hand Operated FIXTURE CLAMP



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2. **SELF POSITIONING** horizontal, vertical or upside down—strap will not fall out of position even in unclamped position.

3. **WIDER APPLICATION—** SWINGLOCK can be operated in restricted areas where there is not enough room for forward and backward strap movement.

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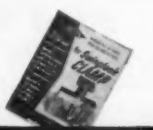

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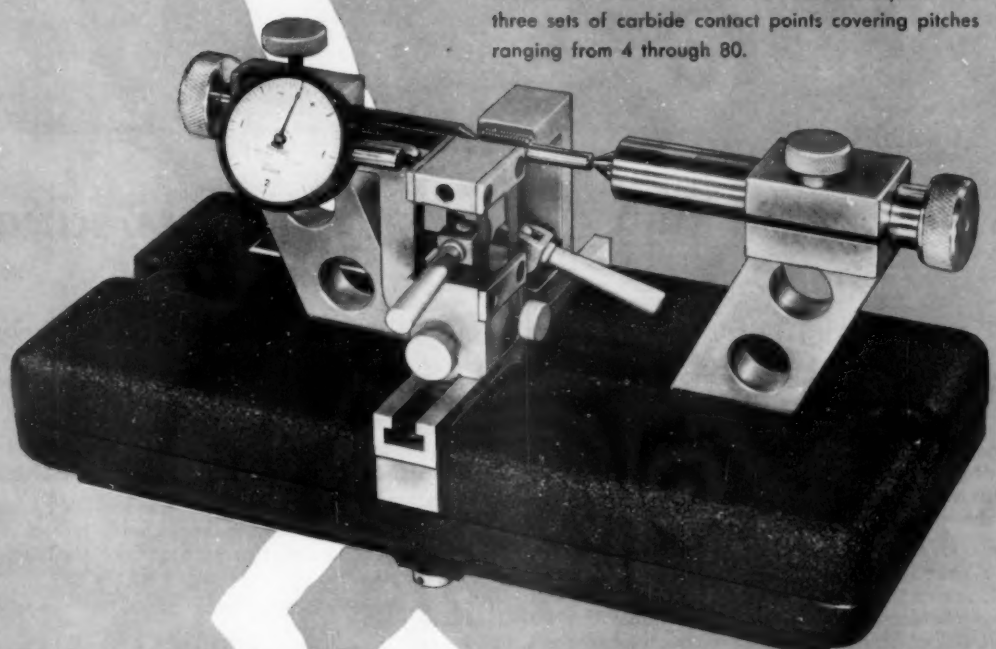
DRUNKEN THREAD CHECKER

Now, with the PMCo Drunken Thread Checker, it is possible to accurately check another element—"drunken threads." This new instrument, developed after many years of study, is manufactured of the finest materials, by a team of expert craftsmen. It simplifies accurate reading of helix deviation.

The PMCo Drunken Thread Checker has a capacity up to 3¼" diameter. Maximum measuring distance between centers is 5⅝". It is furnished complete with three sets of carbide contact points covering pitches ranging from 4 through 80.



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Today Get the Pipe Machinery Co. "Drunken Thread Checker" Pamphlet #2. Fill in this coupon.

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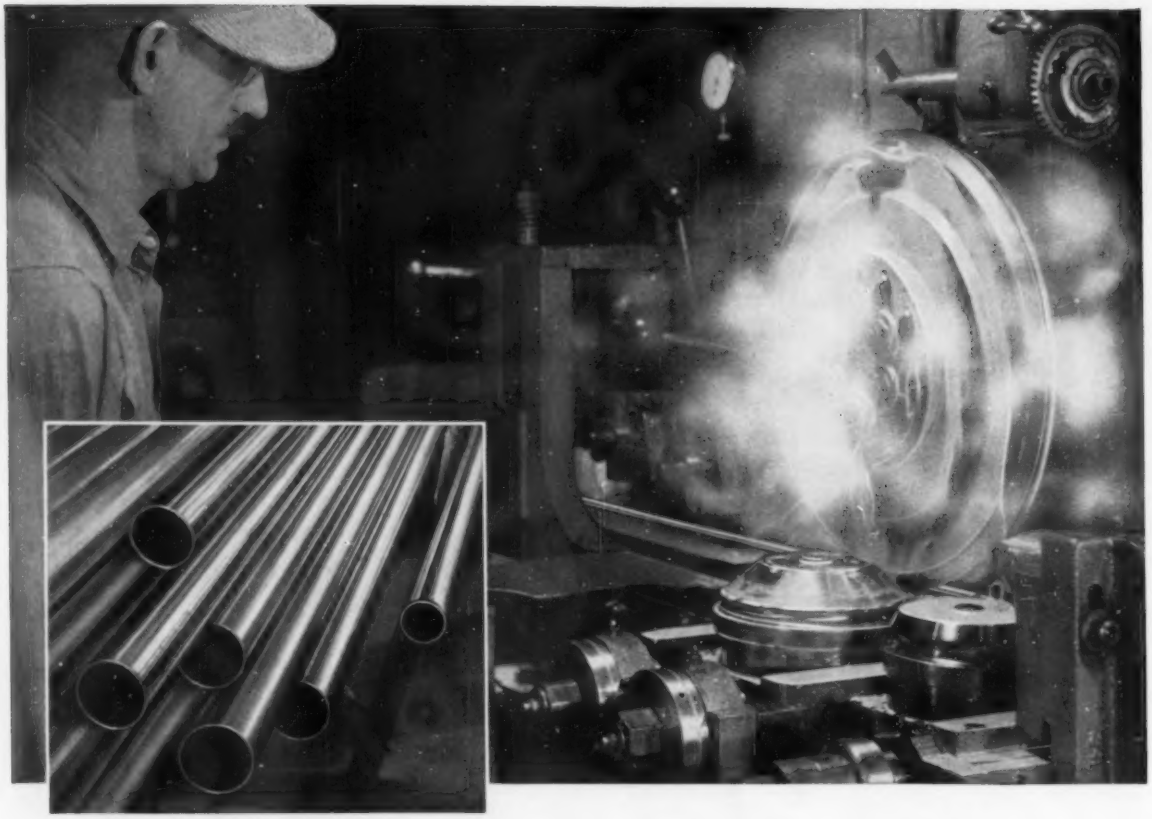


IN ELECTRIC-WELD PIPE AND TUBE MAKING

Yoder leads the way

to higher speeds and quality at lower cost

In the short period from 1938 to 1955, the production of electric welded pipe and tubing grew from 269,000 tons to over 3,000,000 tons. This phenomenal rate of growth—over two and one-half times faster than that of the pipe and tube making industry as a whole—to a large extent resulted from a series of important improvements in tube mill design, all introduced by Yoder.

First came the Yoder rotating welding transformer, in 1938. The economic and other benefits conferred by this epoch making innovation were further augmented by other technological advances scored by Yoder in the years that followed. The result was that electric-weld pipe and tube making became the child prodigy of the fast growing pipe and tube making industry.

Latest, and perhaps the greatest, of these developments is the cold forming and induction welding at high speeds of *aluminum, magnesium, brass, nickel, monel, and other non-ferrous metals and alloys.* This process is especially economical for making light and medium gauge tubes in sizes up to 8 in. dia. More and more leading non-ferrous metal producers and fabricators are installing these mills.

More complete information about this and other interesting Yoder developments in pipe and tube mill equipment may be had merely by asking for any of the following publications:

- ☐ Resistance-Weld Mills for making Steel Tubing up to 4" diameter.
- ☐ Induction-Weld Mills for making Non-ferrous Tubing.
- ☐ Resistance-Weld Mills for Steel Pipe up to 24" diameter.

THE YODER COMPANY

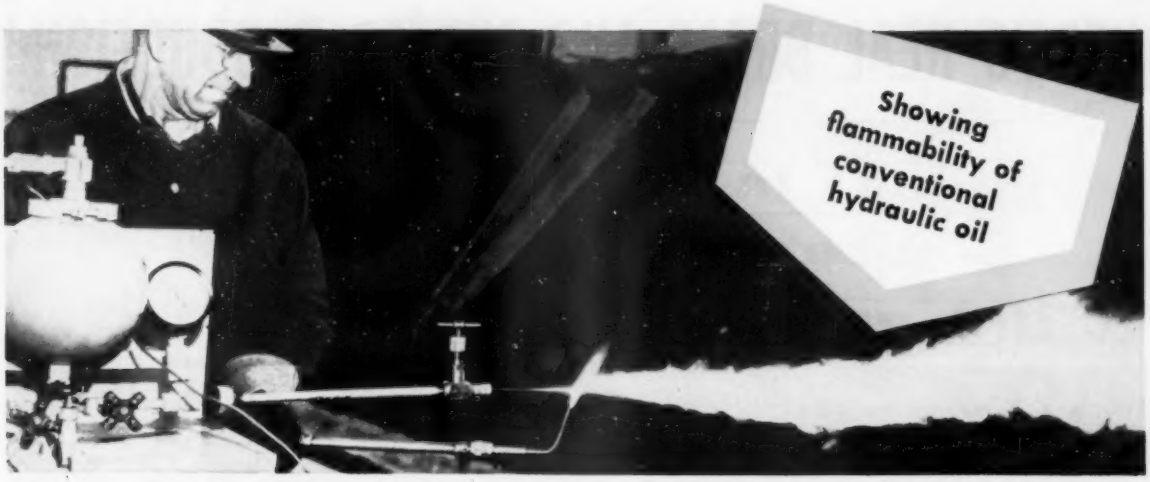
5525 Walworth Avenue **Cleveland 2, Ohio**

ENGINEERING YODER MANUFACTURING

PIPE AND TUBE MILLS—Electric Weld

ROTARY SLITTING LINES

COLD ROLL FORMING MACHINES



Flame tests prove its fire-snuffing ability

SHELL IRUS FLUID 902

Entirely new formula: Shell Irus Fluid 902 is a special formulation . . . product of three years' development and field testing. It is suitable for nearly all industrial hydraulic systems, as a direct replacement for presently used oils. *Here is a fire-resistant hydraulic fluid that can be widely used.*

Non-corrosive: Shell Irus Fluid 902 contains no corrosive ingredients. It has no harmful effects on seals, fittings or bearings. It does not promote rust.

No major modification necessary . . . simply clean present fluid thoroughly out of system and replace directly with Shell Irus Fluid 902. You can use it with complete confidence. Write for test data and all information.

SHELL OIL COMPANY

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100 BUSH STREET, SAN FRANCISCO 6, CALIFORNIA

SHELL

HERE'S REAL BREAD-AND-BUTTER PRODUCTION!

Warner & Swasey 1-A combines power and instantaneous speed changes with standard tooling for top efficiency on this small lot job.

The practical shop man knows that, after all the smoke has cleared about fancy attachments and special tools, most small lot work depends on his real "bread and butter" producer—the versatile, standard-tooled turret lathe.

And here's a typical small lot bar job, a 10-inch pinion shaft, that demonstrates this point. It requires the flexibility of standard tooling, power to really hog metal, and a fast selection of the most efficient cutting speeds. A new Warner & Swasey 1-A Extra Heavy Duty Turret Lathe, equipped with standard tools, does the job in 4½ minutes—*real metal turning efficiency!*

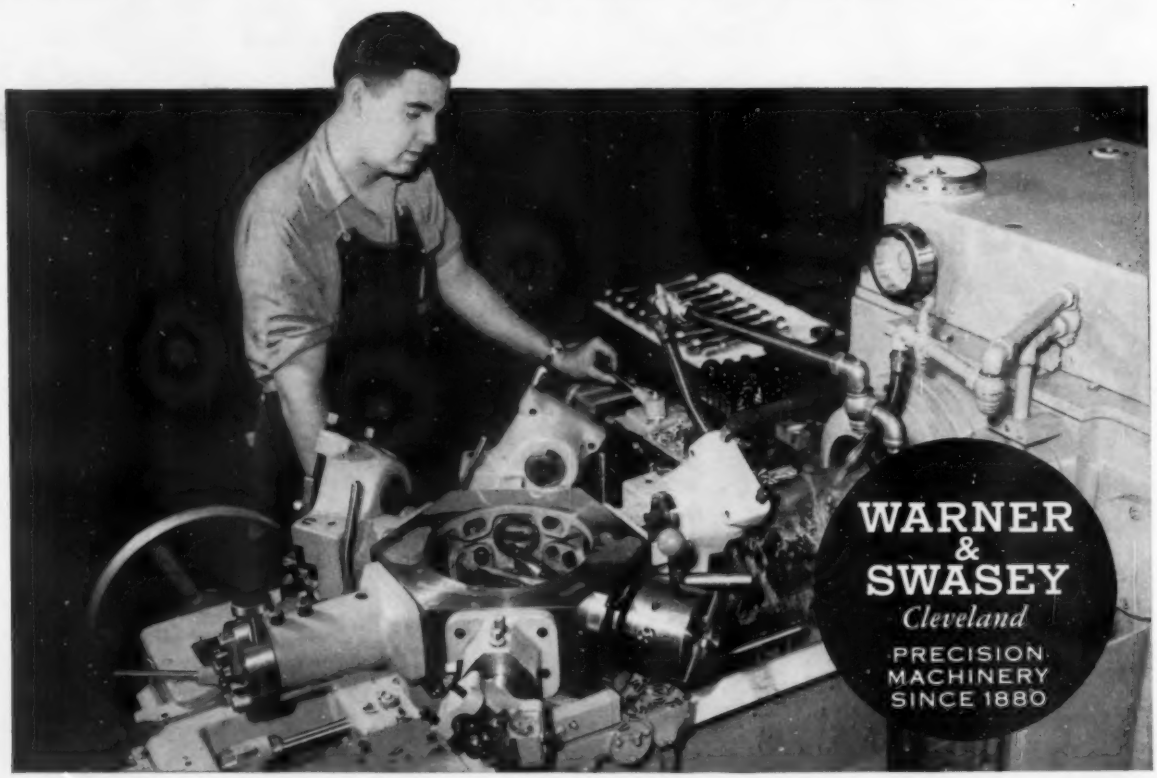
It requires a variety of cuts with 7 speed changes. The 1-A's 16-speed, all-clutch head, with its pre-selector, delivers them instantaneously! With a two-speed motor, a total of 32 unduplicated speeds provided a wide range from which the seven most efficient could be selected.

First cut in this high carbon steel shaft is taken with a standard single cutter turner, using a carbide cutter. It is ½-inch deep and consumes 30 horsepower! This shows the necessity for a Warner & Swasey's power in a machine this size.

Second and third turning cuts are also taken with single cutter turners, using cutters with mechanically-held, throw-away carbide tips.

Traditional Warner & Swasey ease of machine handling, enhanced by the new hydraulically-operated collet chuck and bar feed, not only cuts cycle time but cuts operator fatigue—puts more pieces on the floor at the end of each day!

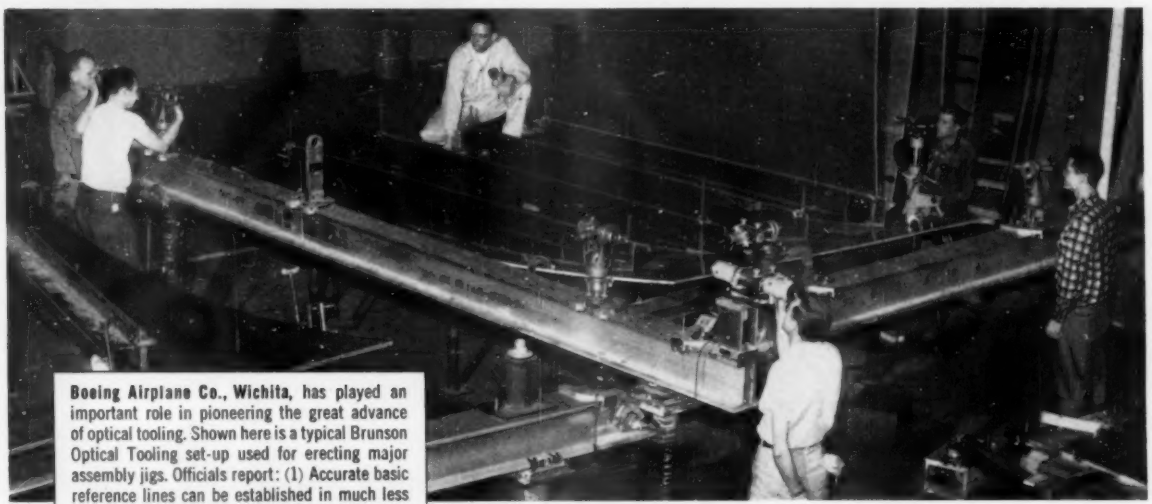
Compare this job with similar ones in your shop. If the comparison indicates a need for greater turning efficiency, call in your nearest Warner & Swasey Field Representative.



YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS...WITH A WARNER & SWASEY

Revolutionary Measuring and Aligning Method, Proved in Aircraft Industry, Can Work for You, Too!

New Brunson Optical Tooling cuts set-up time up to 90%, gives accuracy to less than .001"

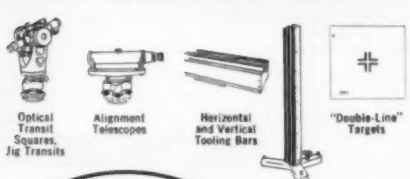


Boeing Airplane Co., Wichita, has played an important role in pioneering the great advance of optical tooling. Shown here is a typical Brunson Optical Tooling set-up used for erecting major assembly jigs. Officials report: (1) Accurate basic reference lines can be established in much less time (2) Set-up times are sharply reduced (3) Multiple crew loadings are possible (4) Need for many master tools is eliminated and simplification of gages made possible. Boeing estimates that Optical Tooling has saved more than a quarter-million dollars on second source B-52 tooling.

Investigate the Big Advantages of Brunson Optical Tooling for:

- Aligning and checking alignment of rolls and axles in steel rolling mills, paper machines, conveyor systems, printing presses
- Resetting large workpieces in machining operations.
- Construction of large jigs, mock-ups, and other structures.
- Precision measurement and setting of points in automotive, machining, and lofting work.

LOOK TO BRUNSON FOR THE COMPLETE LINE OF OPTICAL TOOLING EQUIPMENT



Optical Transit Squares, Jig Transits | Alignment Telescopes | Horizontal and Vertical Tooling Bars | "Double-Line" Targets

Now, you can take advantage of this revolutionary method of measuring and aligning—a method that can slash tooling set-up time as much as 90%, provide accuracy in measuring, aligning, and positioning to .001"!

Brunson Optical Tooling applies the extreme precision and versatility of optics to your difficult measuring, aligning, and positioning work. Through the use of highly accurate optical instruments, it establishes optical reference lines parallel to either or both horizontal axes of the object being worked, then establishes optical planes at right angles to those basic reference lines. Points for alignment, positioning, or resetting workpieces can be set quickly to an accuracy of less than .001". By mounting instruments on indexed tooling bars along the basic reference lines, linear measurements can be made with equal ease and precision up to 100 feet in length. A vertical tooling bar or a precision level and height gage permit precise vertical linear measurements.

Pioneer of optical tooling and an established leader in surveying equipment, Brunson offers the most advanced optical tooling equipment. Outstanding is the exclusive design of Brunson's optical transit square that permits use of several instruments simultaneously along one reference line, allowing several crews to work at once.

New, revolutionary Brunson Optical Tooling can handle your difficult measuring and aligning jobs with speed, economy, and accuracy never before possible with taut wire, length bars, or other gages. Mail coupon today.

BRUNSON *The New Standard of Excellence*

Distributed Exclusively by **BRUNING**

America's Leading Supplier of Engineering and Drafting Equipment

Send today for your copy of Brunson's new, fact-filled booklet on optical tooling! It can mean important savings for you!

Charles Bruning Company, Inc., Dept. 104-TE
4700 Montrose Ave., Chicago 41, Illinois

Please send me further information on Brunson Optical Tooling.

Name_____ Title_____

Company_____

Address_____

City_____ Zone___ State_____

CHARLES BRUNING COMPANY, INC., 4700 MONTROSE AVENUE, CHICAGO, ILLINOIS

SAVE on precision DIAL BORE GAGES

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Construction completed, we expect to be in our new modern home very shortly. Located on South Road at Croft Corner (Rt. 9) in Poughkeepsie, New York we are sure that the new quarters, (all on one floor) will make for a smoother flowing, more efficient manufacturing operation.

NILCO

Save 25% by purchasing these beautifully designed, long lasting NILCO Dial Bore Gages in sets!

Save on production costs! Operators using NILCO Dial Bore Gages see the condition of the holes and control the size right at the machine. Better parts and fewer rejects are the result.

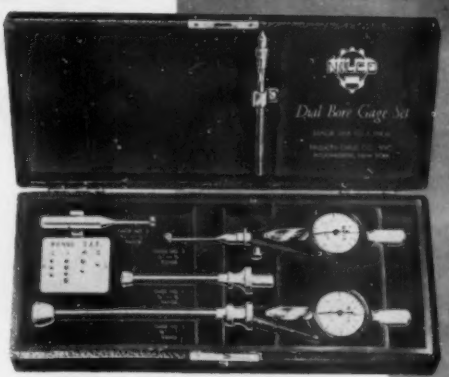
SMALL SHOPS. A set gives small shops large shop precision. No other type of equipment necessary for present or future requirements.

LARGE PLANTS. Ideal for inspection, experimental departments, tool rooms, and receiving inspection departments where it is uneconomical to use numerous individual gages.

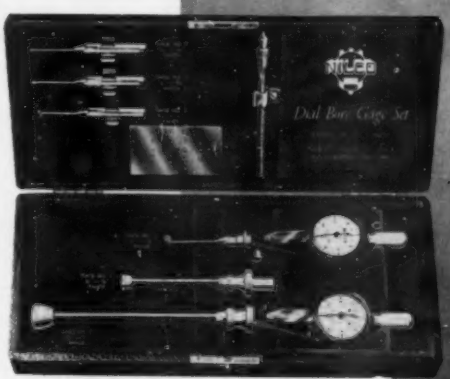
SUBCONTRACTORS. Where runs are varied and quantities small or large, a set will solve all bore gaging problems now and in the future.

QUALITY CONTROL. Gages show the exact size of the parts in .0001". Instantaneous, accurate reading allows quick compilation of data for quality control, anywhere in the plant.

All gages in these sets (and also larger ones) are available as individual gages. For complete information and prices: Write to Nilsson Gage Co., Inc., Poughkeepsie, N. Y.



4 GAGE ECONOMY SET complete in case Range 3/16"—1"—3 point alignment—2 point measurement principle used in all gages.



6 GAGE ECONOMY SET complete in case Range .090"—1".

no special skill required!

Simple to set, simple to use. No bothering with electricity, air connections, elaborate devices or expensive attachments. Simply place gage in the hole and read.

NILSSON GAGE CO., INC.

Poughkeepsie, New York

Logan

- 12" SWING
- 1" COLLET CAPACITY
- 1⅜" SPINDLE BORE
- 23" and 35" CENTERS
- VARIABLE SPEED OR DOUBLE V-BELT DRIVE

ACCURACY, CAPACITY AND POWER COMBINED IN THIS 12" LATHE

This 12" swing lathe typifies Logan advanced design and rugged construction. Gears are extra wide and strong. Shafts are extra heavy. The lead screw has a full ⅞" diameter. The precision carriage rides on a two-V-way, two-flat-way bed that is rugged, precision ground and warp-free. The heavy spindle turns on oversize ball bearings, no bearing adjustment needed for any speed between 38 and 1575 rpm. This lathe, and every Logan Lathe from 14" swing down to 9" swing, is dynamically balanced before it is shipped. The result is *sustained accuracy* and smooth, quiet power on every lathe turning operation. See your Logan Lathe dealer for more facts—or mail us the coupon below.

No. 2557-V
12" Swing,
Variable Speed Drive
35" Centers

THIS COUPON
will bring you full details on Logan Lathe construction and specifications.

LOGAN ENGINEERING CO.
4901 West Lawrence Avenue, Chicago 30, Ill.

Send me full facts on the Logan line.

Name.....

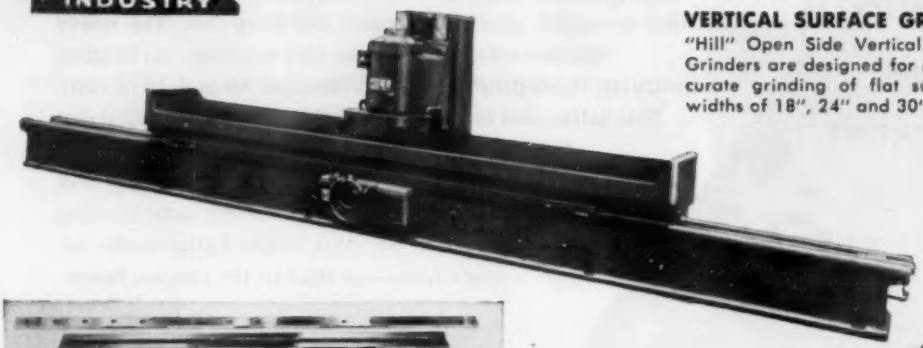
Company.....

Street.....

City.....Zone....State.....

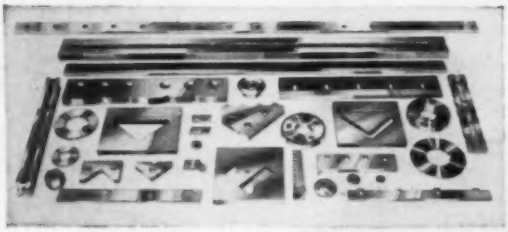
HILL ACME

HILL ACME TOOLS FOR INDUSTRY



VERTICAL SURFACE GRINDERS

"Hill" Open Side Vertical Spindle Hydraulic Surface Grinders are designed for rapid stock removal and accurate grinding of flat surfaces. Furnished in table widths of 18", 24" and 30"; table lengths 60" to 240".



SHEAR KNIVES

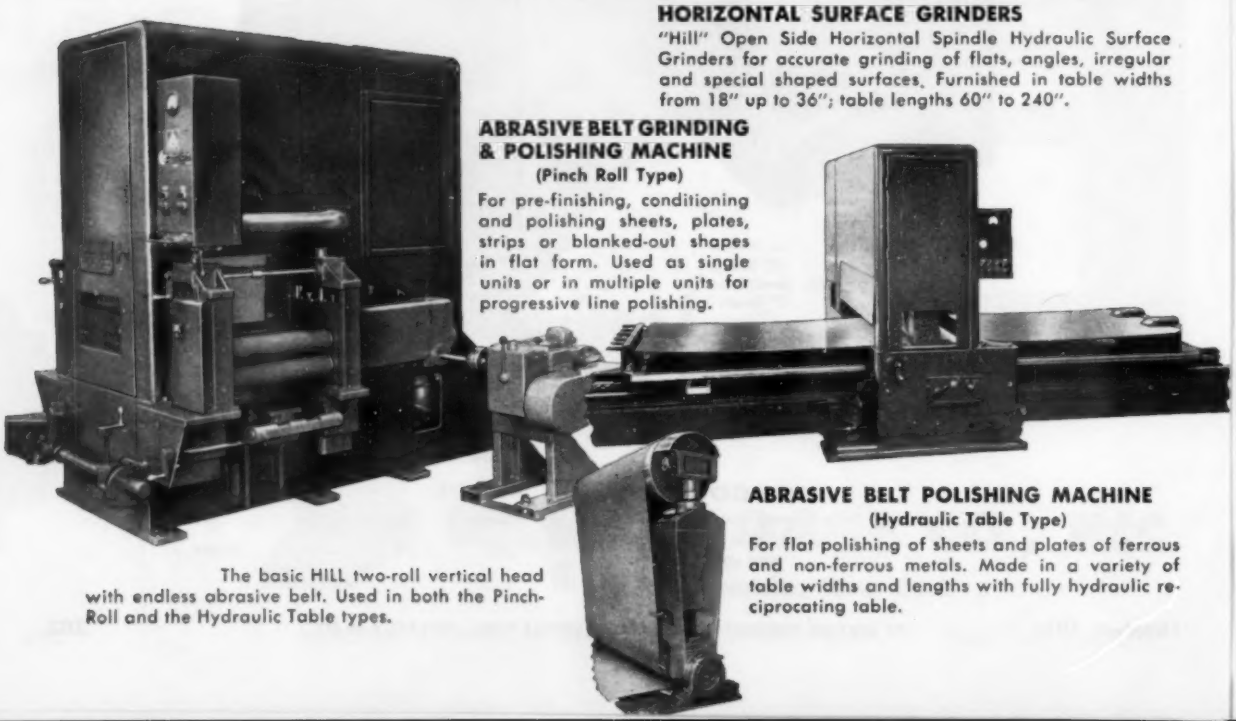
"CLEVELAND" Knives and Shear Blades. Solid and laid steel shear blades; rotary slitting and side trimming knives; metal cutting machine knives.

HORIZONTAL SURFACE GRINDERS

"Hill" Open Side Horizontal Spindle Hydraulic Surface Grinders for accurate grinding of flats, angles, irregular and special shaped surfaces. Furnished in table widths from 18" up to 36"; table lengths 60" to 240".

ABRASIVE BELT GRINDING & POLISHING MACHINE
(Pinch Roll Type)

For pre-finishing, conditioning and polishing sheets, plates, strips or blanked-out shapes in flat form. Used as single units or in multiple units for progressive line polishing.



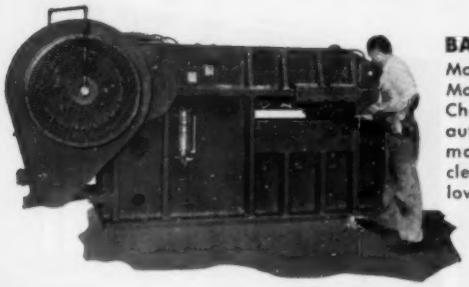
The basic HILL two-roll vertical head with endless abrasive belt. Used in both the Pinch-Roll and the Hydraulic Table types.

ABRASIVE BELT POLISHING MACHINE
(Hydraulic Table Type)

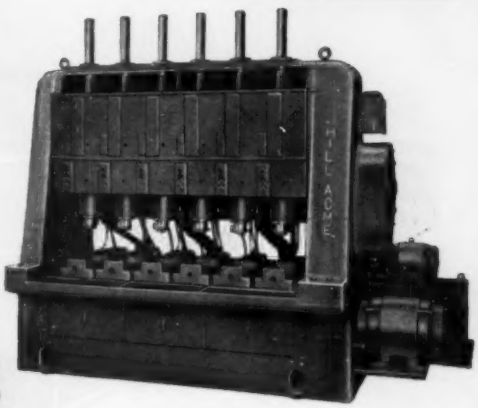
For flat polishing of sheets and plates of ferrous and non-ferrous metals. Made in a variety of table widths and lengths with fully hydraulic reciprocating table.

Tools for Industry

HILL ACME TOOLS FOR INDUSTRY



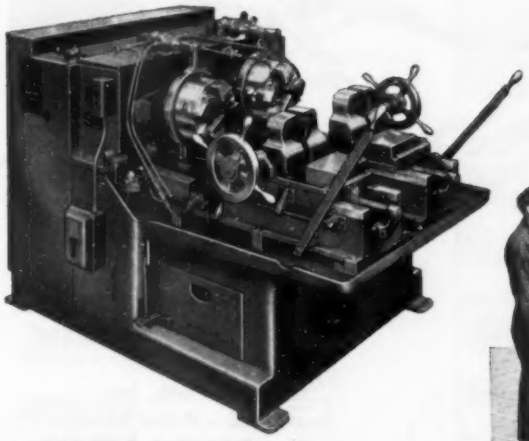
BAR-BILLET SHEARS
Modern, efficient design. Made in 3" to 6½" sizes. Choice of hand, semi-automatic or fully automatic feed. Assures clean, square cuts with low maintenance.

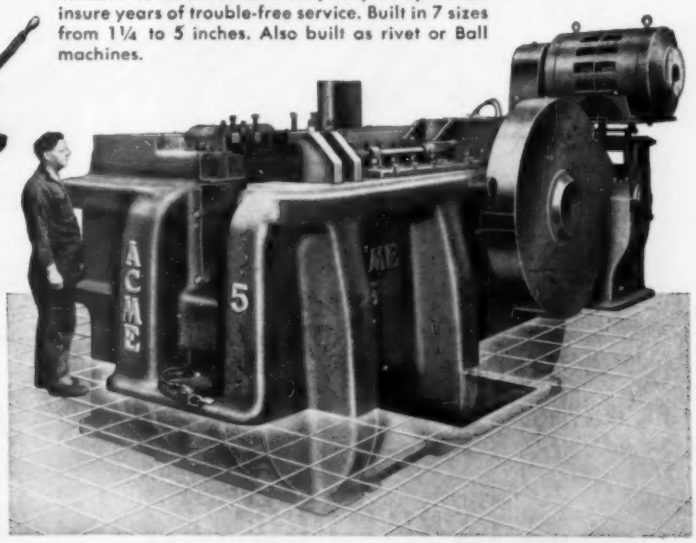


ALLIGATOR SHEARS
"CANTON" Alligator Shears are the most rugged, powerful and trouble free shears ever built for processing scrap. Modern design has produced a stronger shear, with fewer parts, and positive lubrication. Made in a full range of sizes to meet every condition.

TAPPING MACHINES
"ACME" model XC-W six spindle Coupling Tapper. Built in 1" capacity and larger, in 6 or 8 spindle. Can be adapted as a nut tapper.

FORGING MACHINES
"ACME" XN Forging Machines produce accurate, quality forgings for long uninterrupted periods. Massive construction and simplicity of operation insure years of trouble-free service. Built in 7 sizes from 1¼ to 5 inches. Also built as rivet or Ball machines.





THREADING MACHINES
"ACME" XLA Single and Double Spindle Threading Machines are equipped with patented tangent or hob type die head which assures economical, accurate, high speed production. Furnished in sizes from 1" to 3½" capacity.

THE HILL ACME COMPANY

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"HILL" GRINDING & POLISHING MACHINES • HYDRAULIC SURFACE GRINDERS • ALSO MANUFACTURERS OF "ACME" FORGING THREADING • TAPPING MACHINES • "CANTON" ALLIGATOR SHEARS • BILLET SHEARS • "CLEVELAND" KNIVES • SHEAR BLADES

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ALL SIZES ...
ALL SHANKS ...

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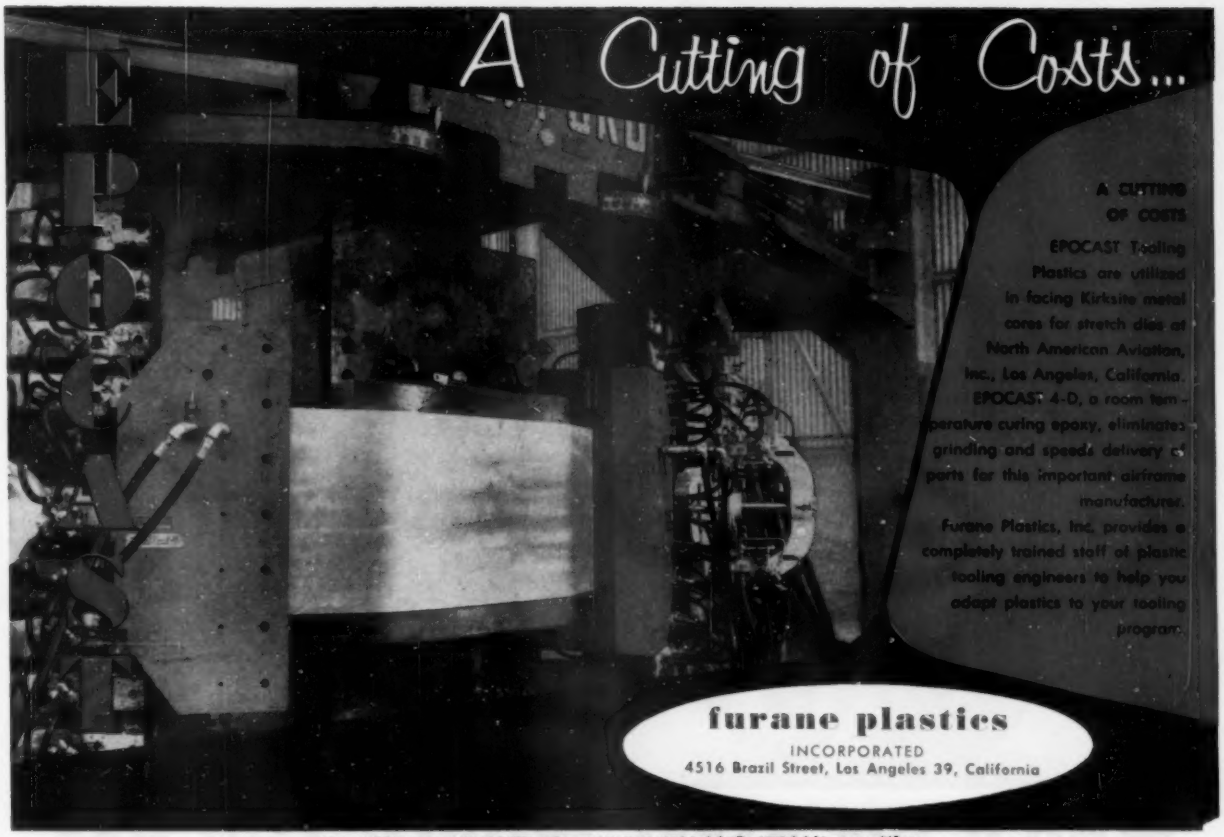
world's largest producer of Sublands


A Cutting of Costs...
A CUTTING OF COSTS
EPOCAST Tooling Plastics are utilized in facing Kirksite metal cores for stretch dies at North American Aviation, Inc., Los Angeles, California. EPOCAST 4-D, a room temperature curing epoxy, eliminates grinding and speeds delivery of parts for this important airframe manufacturer.
Furane Plastics, Inc. provides a completely trained staff of plastic tooling engineers to help you adapt plastics to your tooling program.
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have hundreds of tube end-forming and shaping applications . . .

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Beading • Flaring • Flanging • Sinking • Expanding • Grooving • Threading • Reducing • Double Lap Flaring • Double Lap Flanging.

On tubing up to 6 in. diameter.

Free—New Bulletin T-1 shows and describes the versatility of Vaill Tube End-Forming Machines.

THE VAILL ENGINEERING CO.
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the MAY-O-MATIC Table Has All the Features!

This table is instantly adjustable for height and tilt. It has a solid Basswood metal-edge top, and sliding reference top. Accessories are Auxiliary Drawer unit, and a 5 Drawer Metal Plan File.

For complete information see your local dealer. Or, if necessary, write directly to factory.

Symbol of MAYLINE *Superiority*

MAYLINE COMPANY
611 No. Commerce Street
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METAL PLAN FILE

MAYLINE

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WHICH DIE STEEL WOULD YOU USE

to get "skin-fit" mating—250 million output?

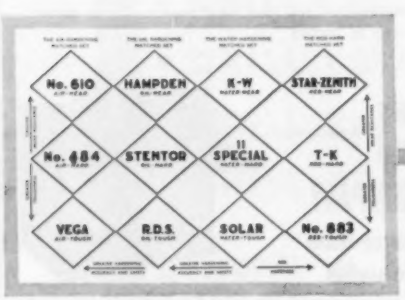
These dies for trimming .003" thick aluminum foil food containers presented the toolroom with this really tough set of tool and die requirements: Make the dies all in one piece . . . finish them to actual size before hardening . . . provide "skin-fit" mating after hardening with no finish grinding . . . and build the dies for multi-million production.

Suppose the decision on which die steel to use were up to you. Would you risk your reputation on any other steel than the one this toolroom decided to use?

Carpenter VEGA (Air-Tough) Die Steel came through with this remarkable performance: After hardening, the toolmaker discovered that the two die sections and two draw rings held to .0003"/.0004" *overall* . . . not just per inch. No finish grinding was necessary . . . a perfect "skin-fit" was assured. Machining the dies from a solid bar of die steel eliminated the need for welded or bolted sections.

The two VEGA rings are engineered to produce a staggering 26 million pieces before any grinding modifications . . . and a total production of 250,000,000 pieces. This Report is one of *hundreds* based upon actual plant records to prove conclusively the improved results obtained with Carpenter Matched Tool and Die Steels.

When will you join the growing number of plants who are enjoying better, lower-cost results? It will pay you to call Carpenter—get in touch with your nearest Carpenter Mill-Branch Warehouse, Office or Distributor today.



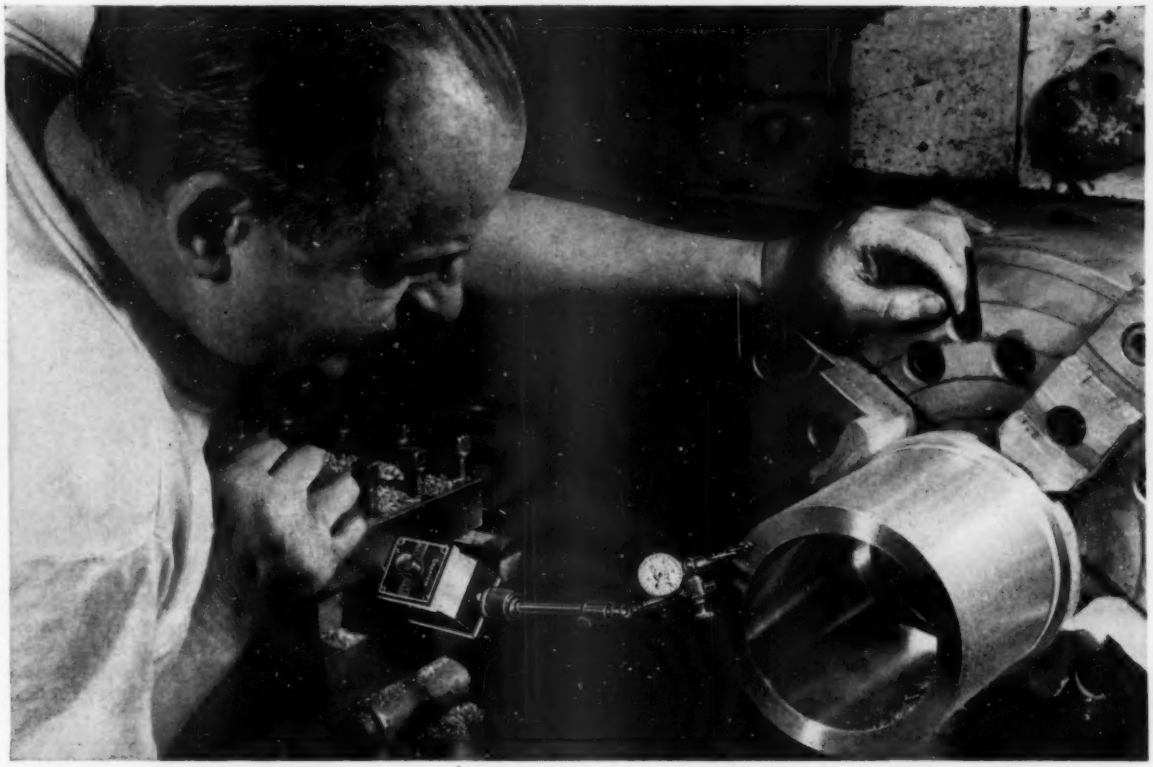
® U. S. Patent Office, The Carpenter Steel Co., Reading, Pa.

Carpenter STEEL

Matched Tool and Die Steels

The Carpenter Steel Company, 154 W. Bern St., Reading, Pa.

Export Dept.: The Carpenter Steel Co., Port Washington, N. Y.—"CARSTEELCO"



here's one way STARRETT helps you...

By constantly bringing out new and better precision measuring tools, Starrett helps you produce precision work faster and at less cost.

This new magnetic base indicator holder is an example. It's quick and easy to set up and adjust. It has an on-off push button which permits mounting the base with one hand, leaving the other free to position the indicator. It has universal adjustments including a fine adjusting screw for accurate final adjustments.

You expect *and get* an extra measure of value and performance when you specify Starrett precision measuring tools and instruments. Get the same full measure of quality by specifying *Starrett* when you buy dial indicators, steel tapes, hacksaws, hole saws, band saws, band knives, and precision ground die and flat stock.

All of these precision-made Starrett products are available through one convenient source of supply — your local Industrial Supply Distributor.

NEW CATALOG NO. 27

Shows the complete Starrett line. Ask your Industrial Supply Distributor or write for free copy. Address Dept. E, The L. S. Starrett Company, Athol, Mass., U. S. A.

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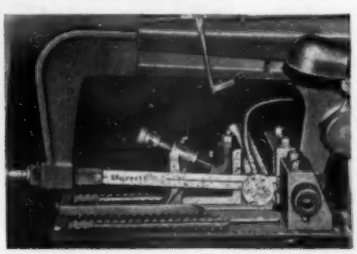
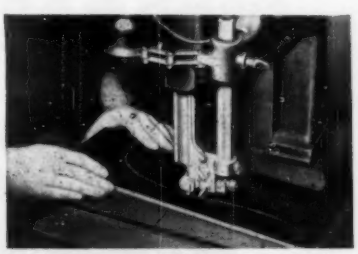
DIAL INDICATORS • STEEL TAPES • PRECISION GROUND FLAT STOCK
HACKSAWS • HOLE SAWS • BAND SAWS • BAND KNIVES

here are many more...

New No. 167 Radius Gages — made of rust-proof stainless steel with Satin Finish.



New Production-Proved Hacksaws are color-identified for job-match selection.



Precision ground Flat Stock and Die Stock — now available in over 1000 sizes.

SEE THE STARRETT EXHIBIT — SPACE 919 — NATIONAL METAL SHOW

the finest high speed lathes

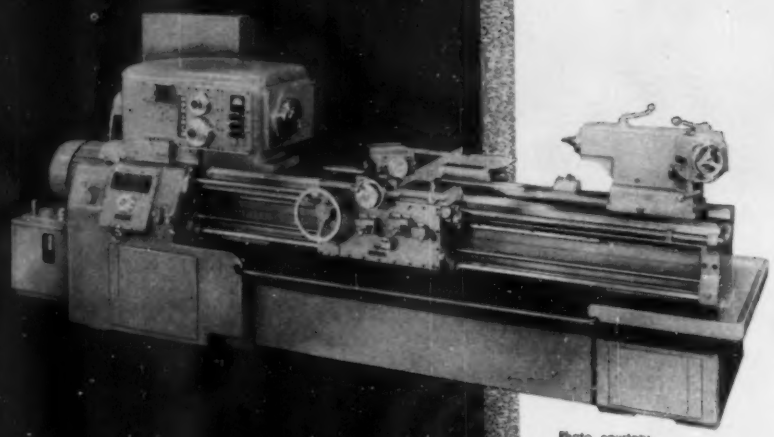
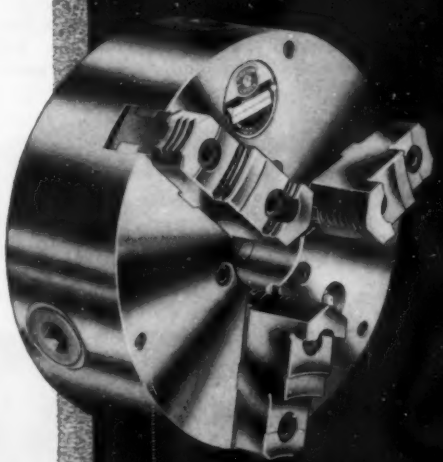


Photo courtesy
The Monarch
Machine Tool Co.

This is Monarch's Series 62 with Preselector Dyna-Shift designed to increase productivity and lengthen tool life. This fine lathe is typical of the quality machine tools built by Monarch. Write for Booklet #1505 for complete data. The Monarch Machine Tool Company, Sidney, Ohio.

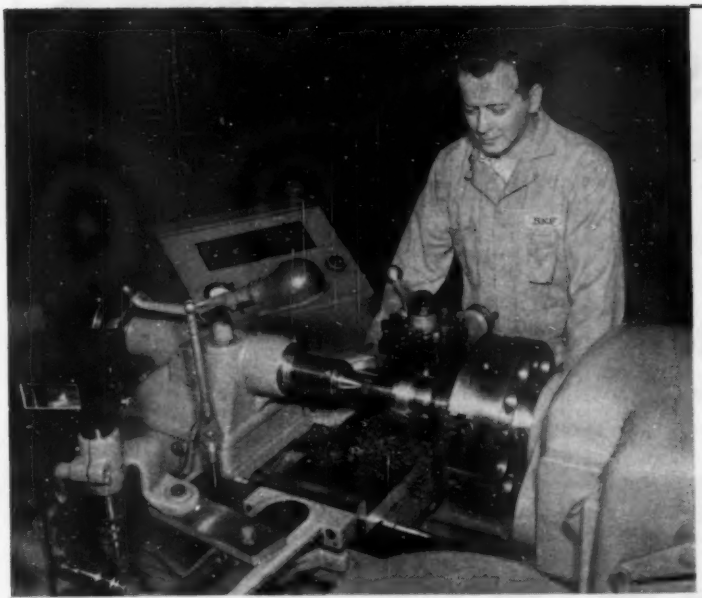
deserve the finest precision chucks



This is Horton's 3-Jaw Scroll Universal Chuck which for over 100 years has been the ideal complement to the world's finest tool room, general purpose and production lathes. Its precision and lasting accuracy make it a part of any production picture. For the complete story on this and Horton's complete line of precision chucks, see the Horton people in your area now.

HORTON
Since 1851
CHUCK

WINDSOR LOCKS, CONN.

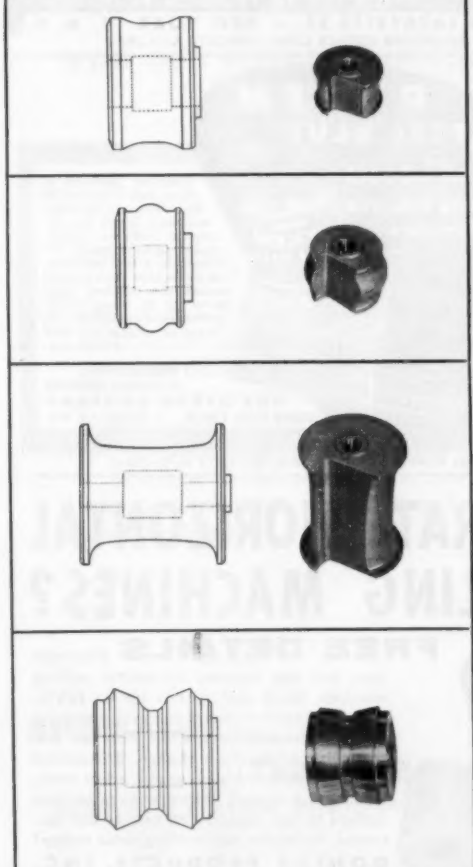


Machining time—cut 40%!

Grinding time—cut 50%!

Grinding wheel cost—cut 25%!

HERE'S TOP FORM TURNING!



Wouldn't you welcome savings like these? S. K. F. Industries, Inc. does, and their happy secret is shown above in an action shot of their Monarch 16" Series 61 Lathe with Keller controls turning circular form tools from the solid. The figures contrast present against previous production on conventional machines, so widely and wastefully used for this work.

Point is, instead of leaving large amount of stock for final grinding, S. K. F. finds that accuracy of new Monarch with Keller controls enables them to turn and shape directly from the solid within about .0005" of finish size. And less-skilled operators can machine them faster—before less grinding.

You can't miss savings like these! Challenge us to deliver you better production whatever you turn—and prove it . . .
The Monarch Machine Tool Company, Sidney, Ohio

♦ While flat templates are generally employed with Keller controls, S. K. F. achieves the necessary high accuracy by so positioning master work pieces between centers that stylus follows sharp edge of gash in form tool master. Another savings.

Monarch
ACCURACY • ECONOMY • LONG LIFE
TURNING MACHINES
FOR A BETTER TURN FASTER . . . TURN TO MONARCH

Cut Inspection Costs

by employing the *added* accuracy and speed of a

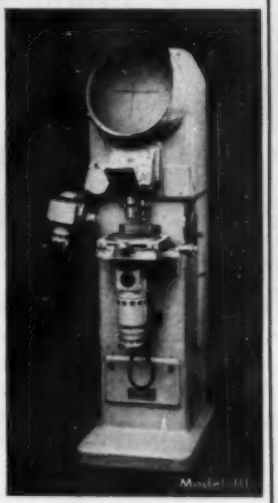
NIKON

Optical Comparator

Permits the study and measurement of surface textures as well as edge contours

A Nikon Optical Comparator permits critical examination of small objects, by projecting their magnified images onto a viewing screen. Because the magnifications are precise, the dimensions of the object can be readily derived from measurements taken of the projected image.

For example, a precise enlarged contour pattern on a translucent sheet, placed onto the viewing screen, can serve to define the tolerance limits of an object or part under inspection. Several critical points can be checked simultaneously. Errors in judgment are virtually eliminated. The most intricate contours, and minute parts, are easily gaged by this technique.



Surface Illumination

One of the important features of the Nikon Optical Comparator is the added facility for surface illumination. This permits the surface topography of any material to be closely examined—for texture, finish, corrosion, wear, etc.

Nikon Optical Comparators are equipped with lens turrets —which permit rapid interchange to selected magnifications—and with fixed adjustment positions for condensers, to provide maximum illumination efficiency at each magnification.

Bright, Even Illumination

Most impressive in the performance of the Nikon Optical Comparators are the extreme accuracy, the overall sharpness of the projected viewing image, and the even brightness of illumination. These are functions of optics, a field in which Nikon has already demonstrated outstanding achievements in the development of new optical glass techniques, photographic lenses, prism binoculars, ophthalmic and other scientific instruments.

Another attractive advantage of the Nikon Optical Comparators is their surprisingly low cost.

Nikon Bench Model Comparators are also available

For specifications and prices, write to: Dept. ZK-20

NIKON INCORPORATED 251 Fourth Avenue, New York 10, N.Y.

Stereo and Research Microscopes, Surveyor's Transits and other precision optical equipment

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FOR SPUR - WORM AND HELICAL & BEVEL GEARS
ABOVE PHOTO SHOWS SET-UP FOR WORM GEARS TO CHECK CENTER DISTANCE, CONTACT OF TEETH, RUNOUT, ETC.
CYLINDRICAL BUSHING
ADJUSTABLE V-BLOCK
Scale and Vernier, Ease of adjustment, Convenient Features to hold Worm and Shaft on V-Blocks or Bushing.
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9" - 15" - 24/30" — PLAIN AND UNIVERSAL
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With DYKEM Steel Blue
Without DYKEM Steel Blue
Popular package is 8-oz. can fitted with Bakelite cap holding soft-hair brush for applying right at bench; metal surface ready for layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, prevents metal glare. Increases efficiency and accuracy.
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2303D North 11th St. • St. Louis 6, Mo.

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FREE DETAILS illustrate how you can increase horizontal milling machine feeds and speeds up to 200%. Jergens tapered roller bearing bushing replaces present bronze bushing at low cost without machine change. Eliminates bushing wear, cutter breakage, arbor wear, scoring and chatter. Permits use of carbide cutters to full capacity on new or old machines. Write for cost cutting facts today!

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Dept. TE-10 11106 AVON AVE., CLEVELAND, OHIO

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~~400~~ 1000 sfpm

depth of cut-~~.005~~ 125

sfpm-~~800~~ 1250

"~~un~~machinable"

~~250~~ 2000 sfpm

pieces per hr:-~~20~~ 65

SAE 1035-~~250~~ 1175 sfpm

HS-Steel-~~90~~ 505 sfpm

min. per cut-~~40~~ 4

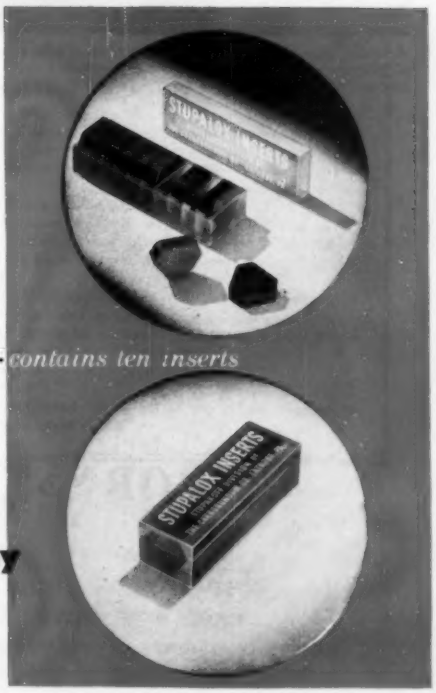
you can scrap your ideas of cutting-tool performance . . .

STUPALOX

introduces a NEW ERA!

The figures above show the amazing improvements in production obtained through the use of STUPALOX sintered oxide cutting tools in place of tools previously used. Actually the figures are conservative, because tool performance in many cases was limited by inadequate power and rigidity of the machine tool.

Stupalox Tools are available now in commercial quantities, and a variety of styles and sizes of inserts. Write for complete data.



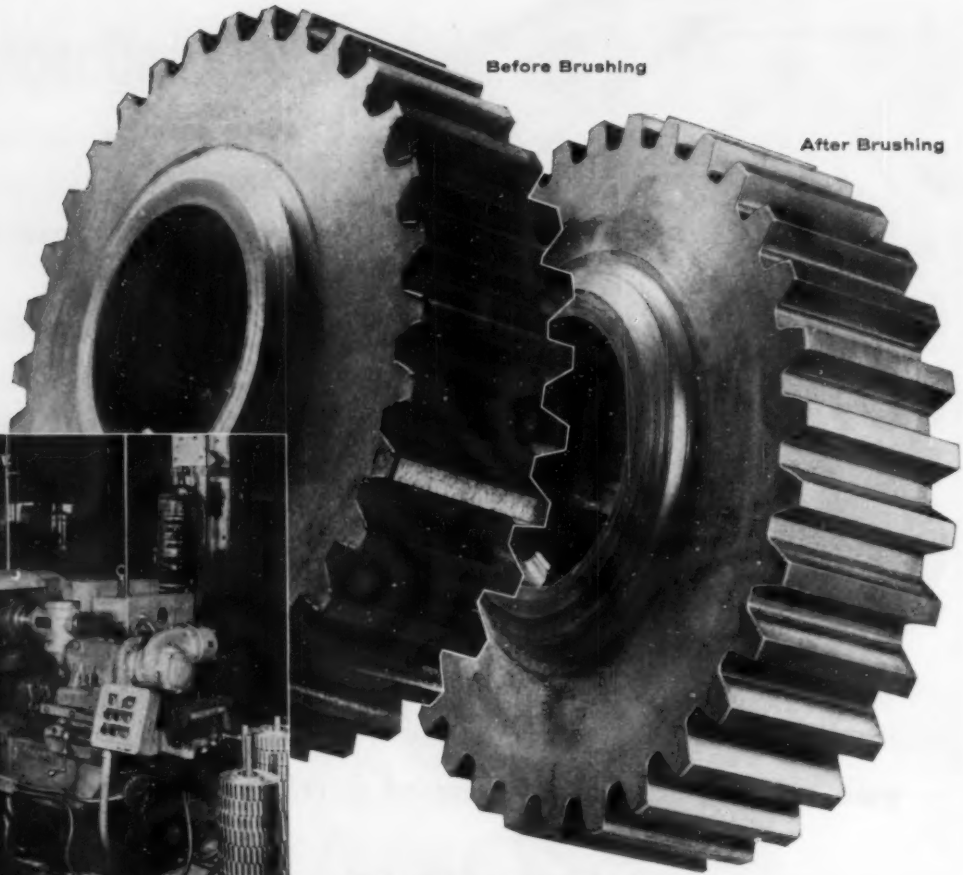
HANDY PACKAGE — *contains ten inserts*

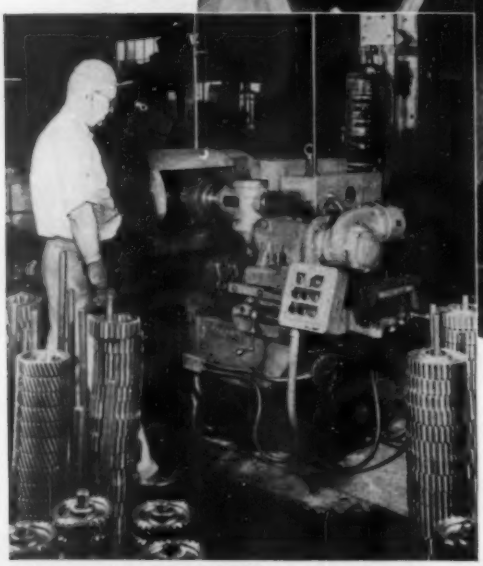
This compact plastic box provides a practical container for ten Stupalox sintered oxide inserts.

STUPAKOFF DIVISION OF

The CARBORUNDUM Company

WRITE DEPT. TE LATROBE, PENNSYLVANIA





A leading machine company, supplying gears for mining and a variety of other heavy machinery, uses Osborn's Brushamatic 4 and a brushing cycle of 6 seconds a side to finish these gears in lots of 20 and up.

Pays Off...
25 for 1

REMOVING burrs from the teeth and internal spline of this gear was once a 5 minute, hand filing operation. Using Osborn Brushamatic® methods, only 12 seconds are required to remove these burrs. In addition, power brushing blends all surface junctures, reducing fracture-causing concentrations of stress.

An **O**sborn **B**rushing **A**nalysis, made in your plant and at no obligation, will show how *you* can improve quality while making similar savings in finishing time and cost. Write *The Osborn Manufacturing Company, Dept. K-28, 5401 Hamilton Avenue, Cleveland 14, Ohio.*

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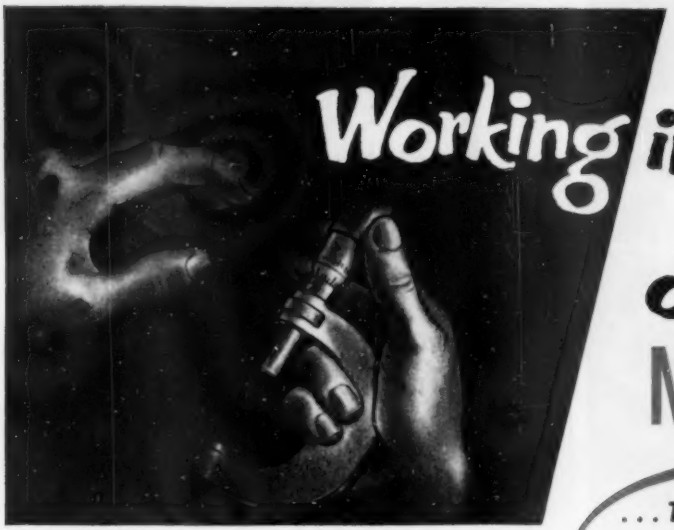
BRUSHING MACHINES • FOUNDRY MOLDING MACHINES

Osborn Brushes



Working in the dark on TITANIUM MACHINING?

. . . THESE RECOMMENDED FEEDS AND SPEEDS FROM ADAMAS WILL HELP END YOUR DIFFICULTIES!

● Now your problems in machining titanium can be considerably lessened with these valuable facts and figures tabulated from *actual production runs* by several of the East Coast's largest aircraft and engine producers.

Choice of ADAMAS carbide for these titanium jobs was determined through pre-testing against the grades of three other leading carbide producers. Against this stiff competition, ADAMAS outperformed all other grades by *4 or 5 to 1!*

If you're already machining titanium or planning to, be sure to specify —

ADAMAS Grade BB for improved performance in heavy roughing and scale cuts.

ADAMAS Grade B, the ideal grade for general machining and semi-roughing.

ADAMAS Grade A for perfect finish turning and milling operations.

Since the proof of the carbide is in the cutting and not the advertising, don't read our claims—test them! Plan a test of ADAMAS' grades for titanium today!

ADAMAS RECOMMENDED FEEDS AND SPEEDS for machining TITANIUM ALLOYS*

(For machining commercially pure titanium, type TI-75A, double speeds.)

	Scaly Forgings	No scale semi-roughing	Finish turning, boring & facing	Milling
Grade of Carbide	ADAMAS Grade BB†	ADAMAS Grade B	ADAMAS Grade A	ADAMAS Grade A
SFPM	50	150 - 200	300	350
Feed	.010 - .020	.010 - .020	.005 - .010	.003 per tooth
Depth of Cut	.250 - .500	.250	.015 - .032	

HELPFUL "TIPS"

How To Eliminate *Vibration*

To end tool vibration, use as large a shank size as possible on the tool. For severe roughing or scaly cuts use a high lead angle. Another "tip" is to hone a 45° land on the cutting edge approximately .005" to .010" wide . . . or reduce feed.

What To Do About *Scale* or *Oxide*

In machining titanium forgings covered with scale or oxide, use as large a radius as possible on your tool. This radius, however, must be kept below the point where vibration will be encountered.

* These figures represent approximate starting points and should be adjusted to your own machines and set up conditions.

† Figures on ADAMAS Grade BB represent a rough face front flange operation of 682 Titanium Alloy on a Bullard VTL machine. The size of the material was:

Diameter—17½" Length of cut—5"

ADAMAS Grade BB delivered 12-15 pieces per grind. Figures on Grades A & B available upon request.

TEST WITHOUT OBLIGATION! For an actual machine test or detailed titanium machining literature, contact: Technical Service Div., ADAMAS Carbide Corp., Dept. 221, Kenilworth, N. J.

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Bay State Tap & Die Company

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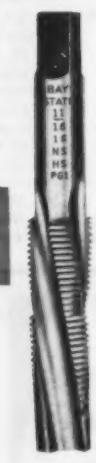

BAY STATE TAPS

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This is the actual size of COMTORPLUG'S dial showing how easily you can read it to fractions of .0001".

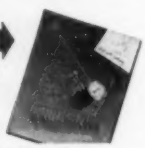
PRECISION INTERNAL GAGE for holes 1/8" to 10" diameter.

What is your gaging problem?

Why not give Comtorplug a chance to solve it?

With a fixed — not passing — reading, Comtorplug shows the exact size of any part of a hole, detecting front or back tapers, ovality, bell mouth, etc. Can be used by anybody — no training program — no hoses, wires or electronic gear.

SEND FOR BULLETIN 49
It may help answer your problem



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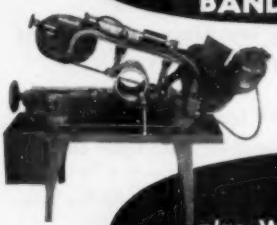
NEW Wells MODEL 600
METAL CUTTING BAND SAW



Larger Capacity *plus* Wells Quality for Greater VALUE and PERFORMANCE

SELECT FEATURES

- Increased capacity—handles up to 6¾" dia., rounds; 6" x 13", rectangular.
- Exclusive Wells "constant-load," feel-proof blade tensioning.
- ⅝" wide blade for more accurate cutting.
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- Sealed type ball bearing motor for full power at low cost.
- Adjustable, uniform gravity feed of counterbalanced frame.

Call your Wells Distributor for information or write for descriptive literature.

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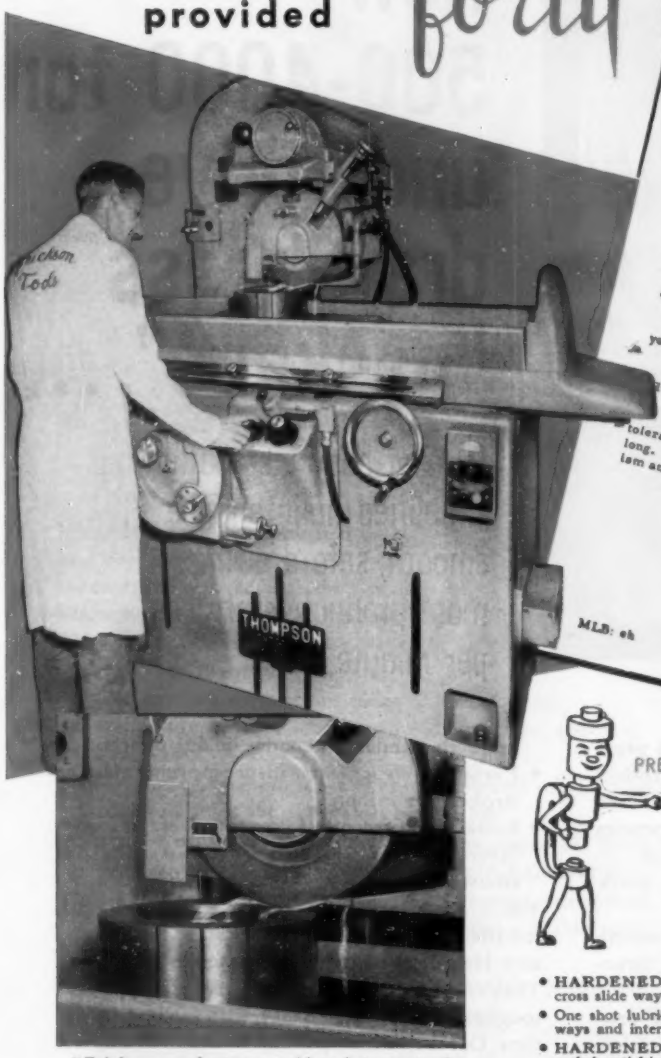
The Erickson Tool Company

asked for at least .0001 for parallelism and size. . .

The Thompson 2F (8x10x24) Super Precision Grinder

provided "forty millionths"



ERICKSON TOOL COMPANY
EAST 83rd AND HAMILTON AVENUE
CLEVELAND 14, OHIO

September 17, 1954

The Thompson Grinder Company
Springfield, Ohio

Attention: Mr. John Wilson,
Vice President.

Gentlemen:

May we take this opportunity to express our satisfaction with your Thompson 2F 8 x 10 x 24 Surface Grinder.

We purchased this grinder on your claim of .0001 for parallelism size. This tolerance is necessary for most of our work.

Upon its arrival we asked a service man to prove this .0001 tolerance, using 5 blocks on a surface of 4 inches wide by 20 inches long. The test blocks showed .00004 (forty millionths) for parallelism and size. This was well within your guarantee.

Yours truly,

ERICKSON TOOL COMPANY

M. L. Benjamin,
President.

MLB: eh

PRECISION PETE says:

"You may be surprised to find that Thompson 2F Grinders cost less than some others and still provide all these features for greater accuracy and longer service. Fast delivery, too!"

"Erickson products are sold and guaranteed to hold extreme accuracy. It is vital that we have the precision equipment necessary to manufacture these products. Our Thompson 2F Grinder delivers this precision. In the above picture we are grinding a #1200 expanding sleeve and hold within .0001 parallelism and size."

- **HARDENED AND GROUND** cross slide ways completely sealed.
- One shot lubrication to cross slide ways and internal saddle bearings.
- **HARDENED AND GROUND** sealed anti-friction vertical slide.
- **HARDENED AND GROUND BED WAYS** with automatic lubrication.
- 3600/1800 R.P.M. 2 speed wheel head. Heavy alloy steel spindle heat treated, runs in super precision ball bearings accurately preloaded, lifetime lubricated.
- Handy control panel.
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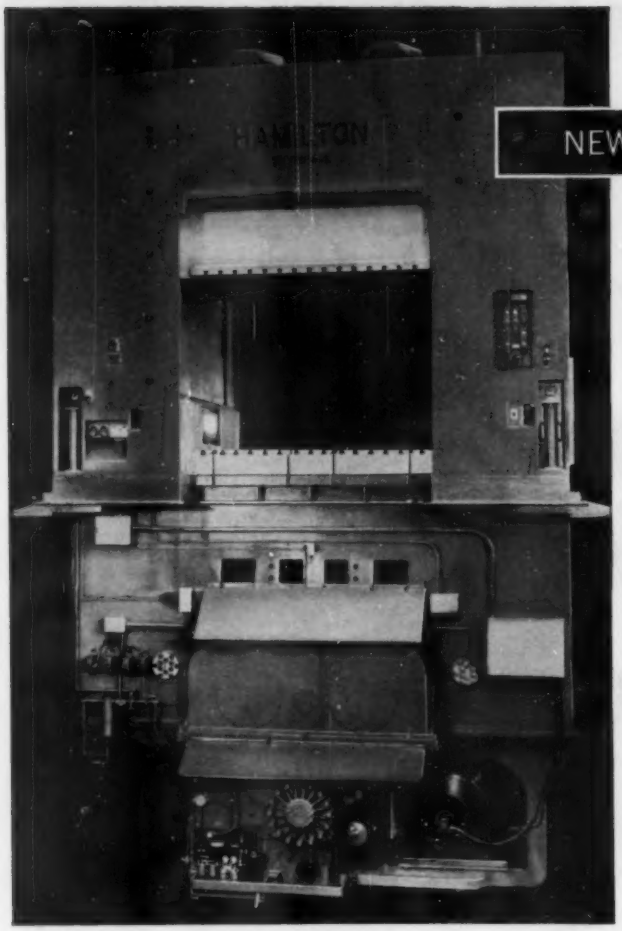
- GROUND THREAD FEED SCREW.
- Automatic wheel TRUING device.
- Longitudinal hand feed with automatic engagement.
- Hydraulic head movement throttle with rapid traverse.
- Hydraulic table movement throttle.
- Elevating hand wheel graduated in .0005".

Call, write or wire for estimate

Thompson Grinders

THE THOMPSON GRINDER COMPANY · SPRINGFIELD, OHIO



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New 500-4000 ton underdrive draw press "package"...

for fast easy installation...
simplified maintenance...
smooth, safe drawing...
more productive strokes
per minute

Thirty years the leader in the mechanical press field, Hamilton now gives you this latest product of dynamic press know-how. An all-new line of 500 to 4000 ton mechanical draw presses engineered for fast, safe drawing operation . . . with each press a "package unit" for quick installation, easy maintenance.

- *Package design* keeps all piping and wiring within the rugged, welded steel press structure. Installation is quick and easy.
- *Hamilton's Exclusive Double-Lube system* provides both pressure and gravity flow lubrication to all bearings.
- *Operating mechanism in the press bed* simplifies inspection and maintenance during operations.
- *Variable cycle sequences* insure more productive strokes per minute.
- *Swivel arrangement of counterbalance cylinders* insures proper alignment when gibs are adjusted.

You'll speed your production while you slash installation and operating costs . . . with these new Hamilton underdrive presses in your shop. They're designed and built to handle your toughest jobs better, faster—with far less downtime. Get the full story today! Write for complete specifications to Dept. 9677, Hamilton Division, BLH Corp., Hamilton, Ohio.

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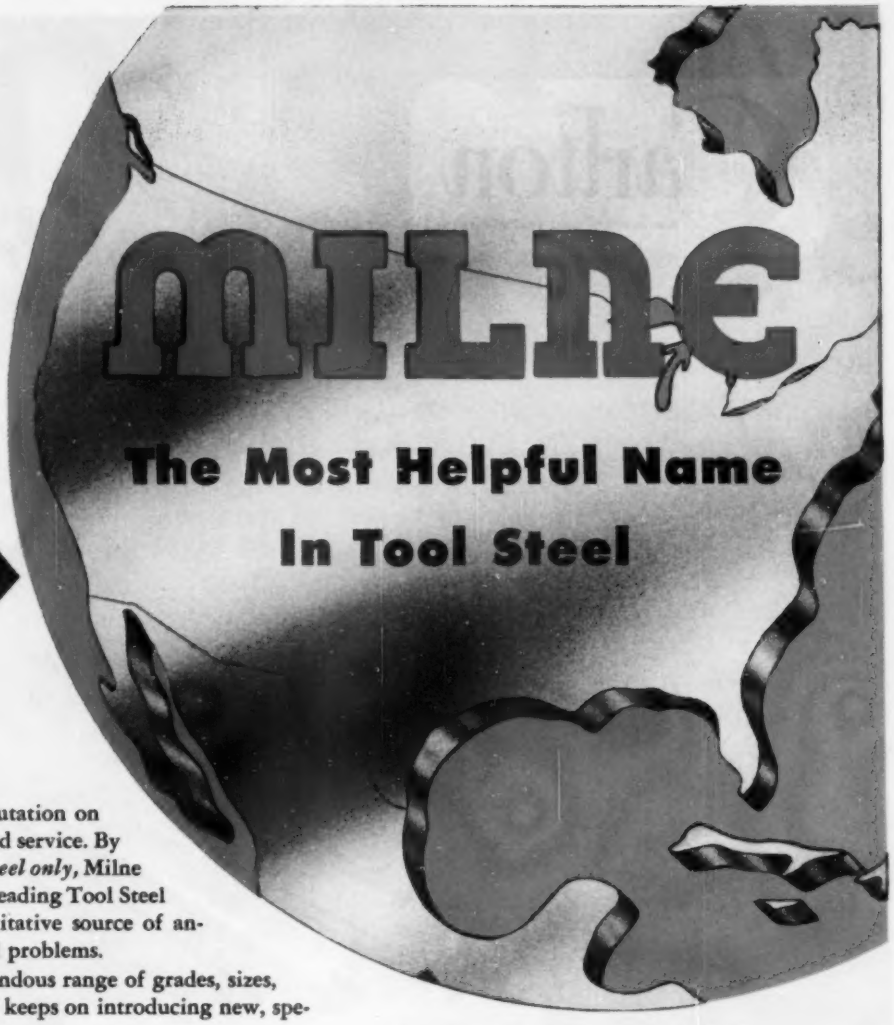

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- Milne stocks a tremendous range of grades, sizes, shapes and finishes and keeps on introducing new, specialized steels.
- Every Milne sales-engineer is an experienced expert who can help pin-point the right steel for the job.
- From experience, Milne knows the importance of "Rush Delivery" on a tool steel order, whether it's in pounds or tons.
- Milne's continent-wide network of warehouses, sales offices and representatives puts a Milne expert and a Milne stock near you.
- All Milne steels are full length Kolorkoted for permanent identification.

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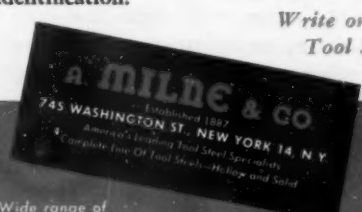

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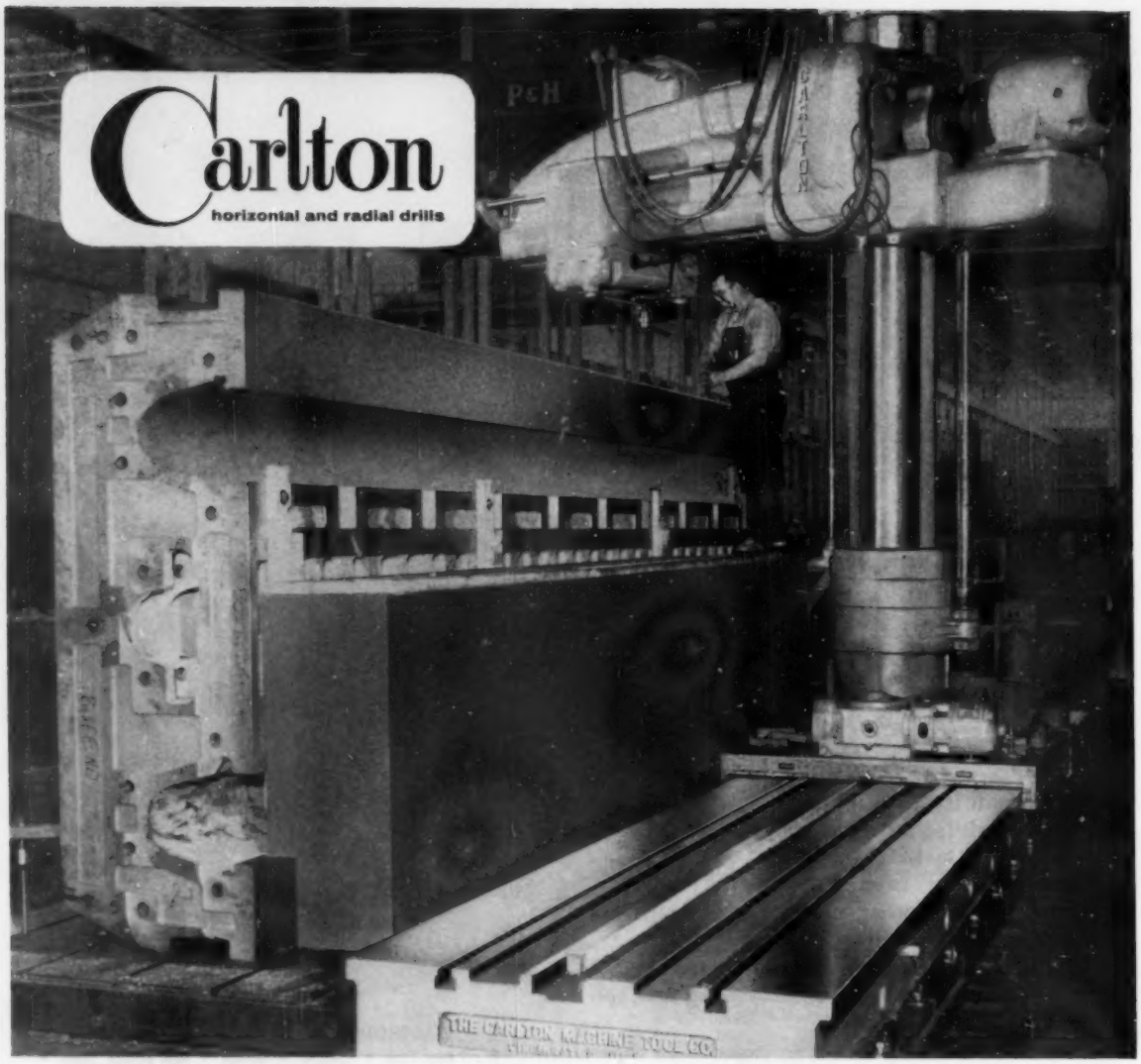
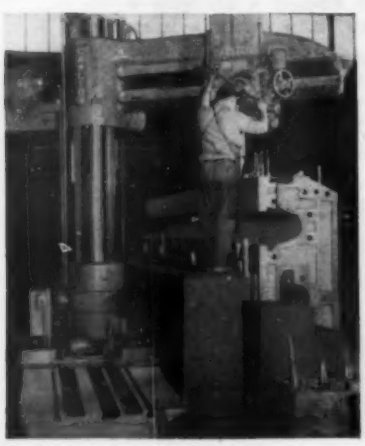
Complete Line of Tool Steels . . Solid • Hollow • Flat Ground



K&T likes Carlton's hole drilling mobility and accuracy



This Carlton radial drill really "gets around" at Kearney & Trecker Corp., Milwaukee. A special sliding bed plate brings Carlton's hole drilling efficiency to bear over the entire length of this enormous 23-foot long K&T milling machine base. It drills 216 holes at one setting without the necessity of lifting so much as an ounce of its 12 tons. Think what this special Carlton mounting means in time, energy and money saved!

And this ingenious mobility means even more when you add to it the many other advantages of Carlton radial drills: low-hung drive, super-precision column clamp, 3-unit power clamping, positive tooth feed clutch and easy, economical maintenance. Arm lengths from 3 feet to 12 feet, column diameters from 9" to 26". Send today for descriptive bulletin. The Carlton Machine Tool Co., Cincinnati 25, Ohio.

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Precision Grinding!
Keener Cutting Edges!

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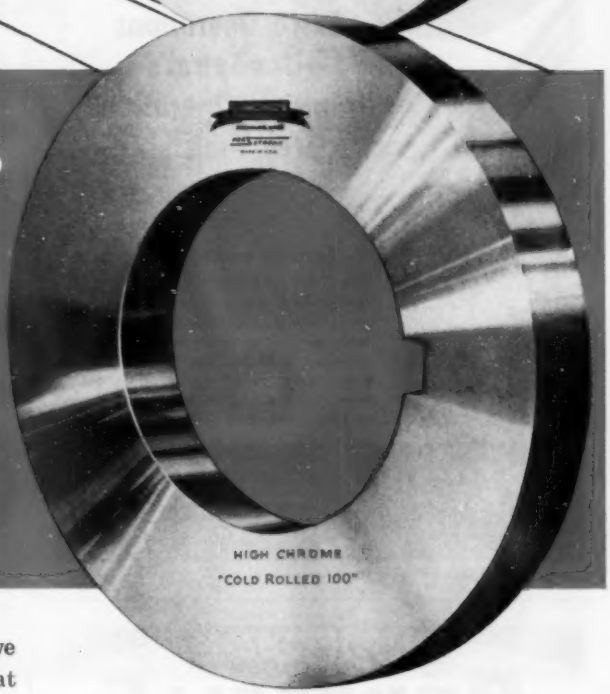

Because you need clean, accurate slitting, we couldn't be fussier about the steel, the heat treating, the grinding and the accuracy of our Red Streak Shear Knives . . . and you get the cleanest, most accurate slitting around!

To begin with, we furnish the *right* Simonds Steel for each shearing application . . . High Chrome, Special Alloy or High Speed . . . forge it for added density and resistance to chipping and then precision grind for the utmost accuracy in operation.

On-the-job results prove the advantages of Simonds high grade tooling, both knives and spacing collars . . . advantages that mean savings in sharpening and replacement costs as well as in cleaner, more accurate slitting.

For the knives you need for your operations send today for the free "Shear Selector Chart" to help you cut costs as well as metal.

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SEPARATOR DISCS

These discs are made of Simonds saw steel — heat treated for added toughness and resistance to wear. They stay flat . . . will last for years. Furnished with either black or ground finish.

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Canadian Factory in Montreal, Que., Simonds Divisions: Simonds Steel Mill, Lockport, N. Y., Heller Tool Co., Newcomerstown, Ohio
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REDUCE PRODUCTION COSTS

Eliminate Extra Operations —Use Spiral's "Multiple-Operation" Step Tools

Carbide and High Speed

Step drills, step reamers, milling cutters, seating and grooving tools, trepanning tools, form tools, carbide and high speed, made to your specs or designed by our engineers to fit your needs. Form ground with "radial relief" gives up to 500% more tool life, imparts smoother finishes on piece parts. Send for details.

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For **BETTER RESULTS IN TAPPING AND REAMING!**

The tougher the set-up is on tapping and reaming jobs, the more you will appreciate Ziegler Floating Tool Holders — because the Ziegler makes it possible to turn out perfect work even though the set-up itself may not be perfect.

The secret lies in the fact that the Ziegler Holder automatically compensates for inaccuracies in set-up to as much as 1/32" on the radius or 1/16" on the diameter.

It always floats freely, without friction or cramping, even under the severest tool-driving strains, and takes any and all end thrusts. It will enable you to turn out work to the finest of tolerances in spite of the fact that the work may not be perfectly aligned with the spindle.

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when only a diamond tool will do the job...

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Mr. J. R. Weidenheimer (center), Plant Superintendent of the Lynch Corporation, and Mr. L. C. Williams (right), Gulf Sales Engineer, check the performance of Gulfcut 21 on an Acme Turret Lathe where a cam is being machined. Steel used is NE8445.

. . . GULFCUT 21 was chosen

by the Lynch Corporation, Anderson, Indiana

"We did not choose Gulfcut 21 at random," says Mr. J. R. Weidenheimer, Plant Superintendent of the Lynch Corporation, well-known glass machinery manufacturer. "Many different cutting oils were tried but Gulfcut 21 proved best in our tests. We feel that it gives better protection to the tool and contributes to a smoother machining operation."

Scores of machine shops have discovered, as the Lynch Corporation did, that Gulfcut 21 is the answer when the job calls for a sulfurized mineral type cutting oil.

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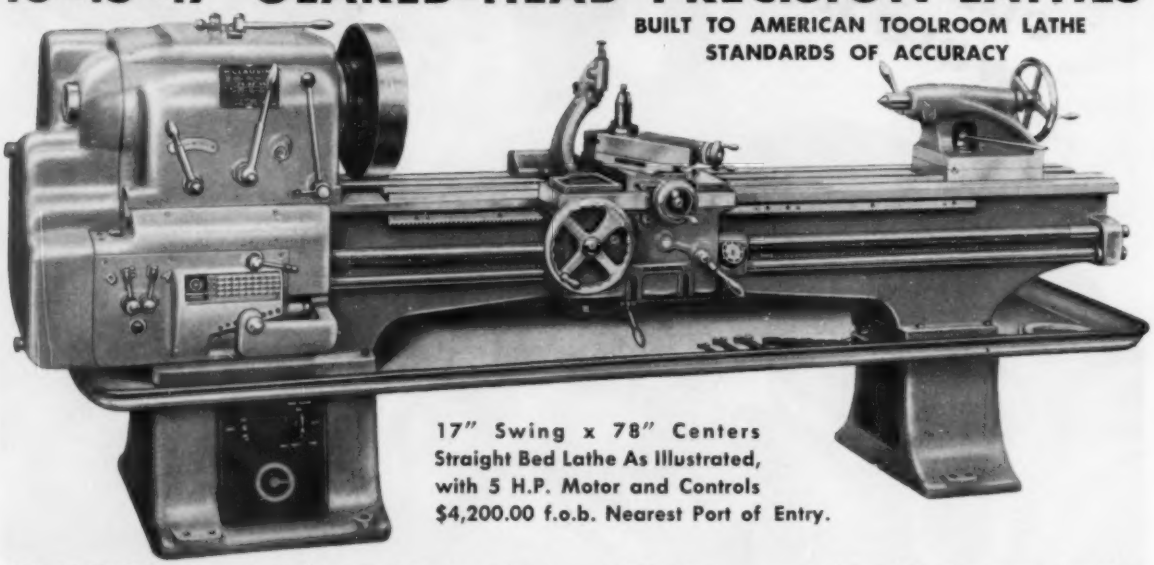

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NOSE TAPER KEY DRIVE	L-2	L-1	L-0

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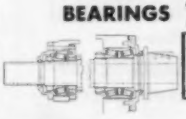

SIZE	17"	15"	13"
FRONT SPINDLE BEARING O.D.	7 1/2"	5 1/2"	4"

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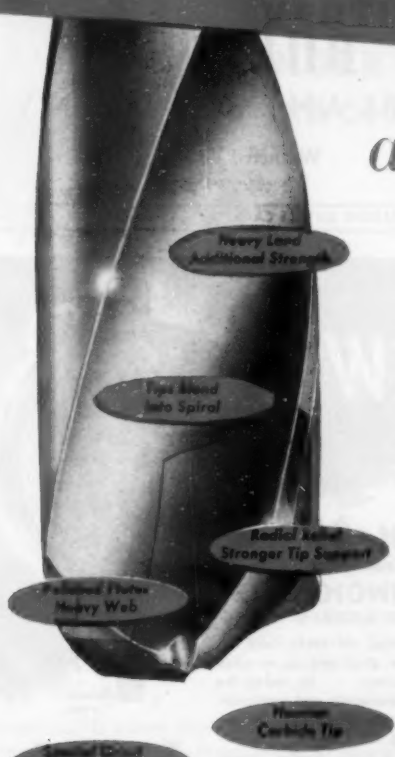
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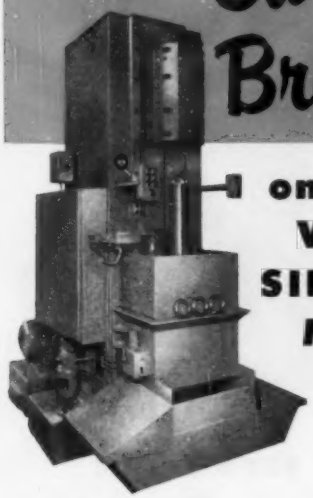
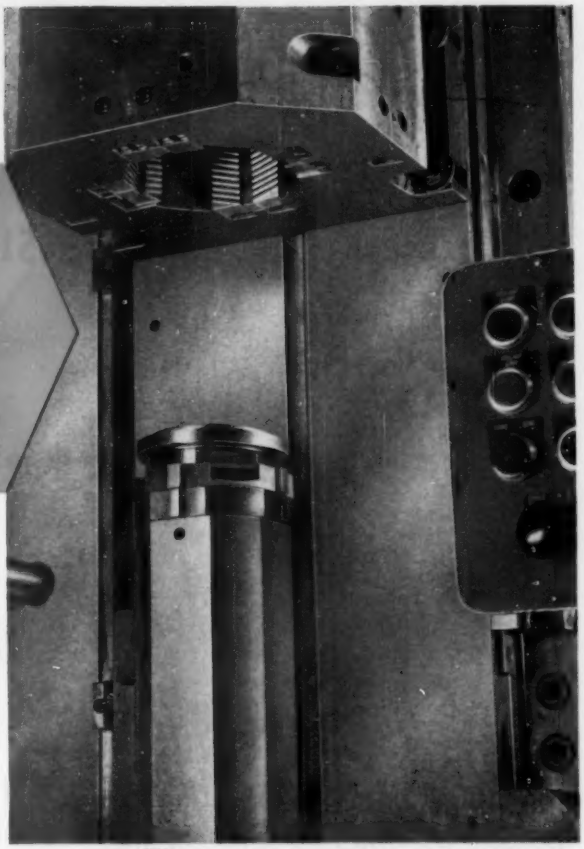
on DETROIT VERTICAL SINGLE RAM MACHINE





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MACHINE—Detroit 10-ton Vertical Single Ram Broaching Machine with 42″ stroke and fixed knee.

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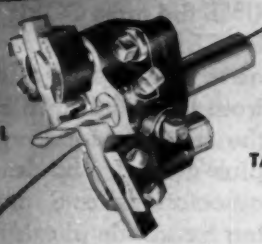

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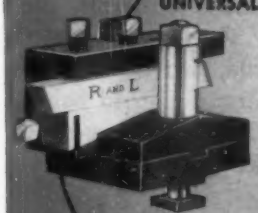
FLOATING DRILL HOLDER



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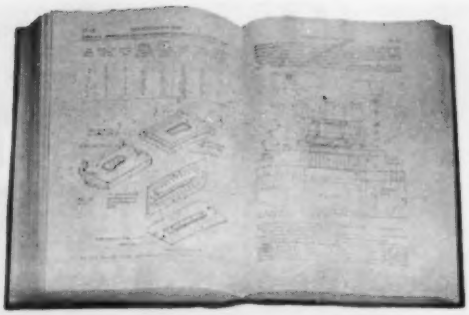

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October 1956 Issue

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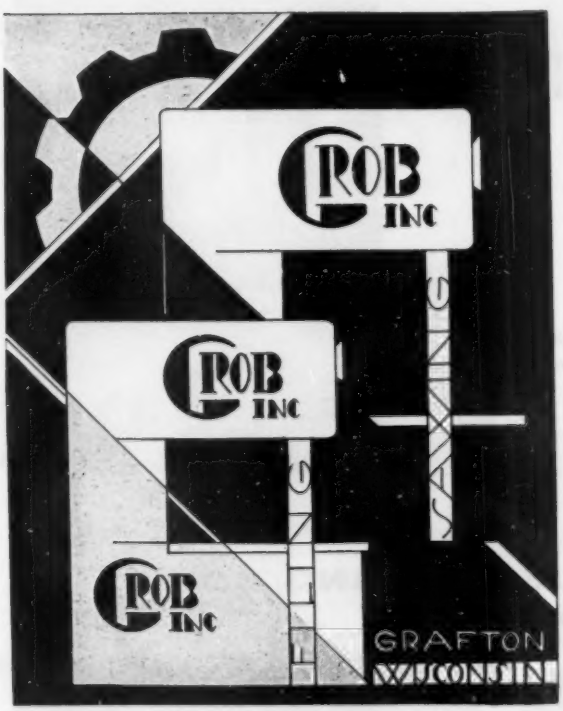

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BALAS solid carbide

PUSHER PADS

RELATIVELY INEXPENSIVE!

Examples of prices for popular machines:

ACME-GRIDLEY		BROWN & SHARPE	
9/16"	$11.50	#00	$ 8.75
1"	17.00	#10	10.75
1¼"	24.00	#11A	11.95

CONE		DAVENPORT	
1"	$17.00	Std. 9/16"	$11.95
1¼"	24.00	Oversize ¾"	13.75
1⅝"	27.00		

NEW BRITAIN-GRIDLEY

1"	$17.00
1¼"	24.00
1⅝"	27.00

Write for folder giving complete details and prices on Balas Carbide Pusher Pads and Model "A" Master Pushers.

BALAS COLLET MANUFACTURING CO.

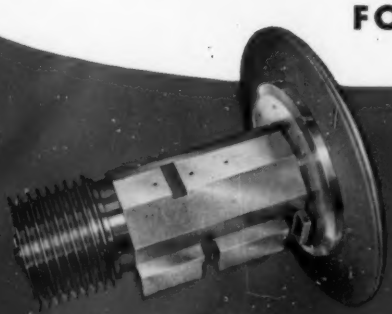
CLEVELAND 14, OHIO

There's an EX-CELL-O

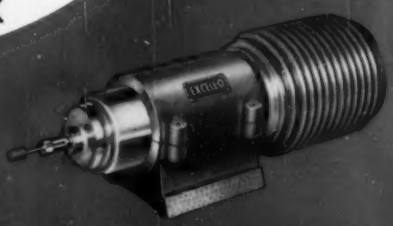
Precision Spindle

BUILT ESPECIALLY FOR YOUR WORK

Single-body, belt-driven internal grinding spindle.



25 hp heavy duty precision spindle with 24" grinding wheel.

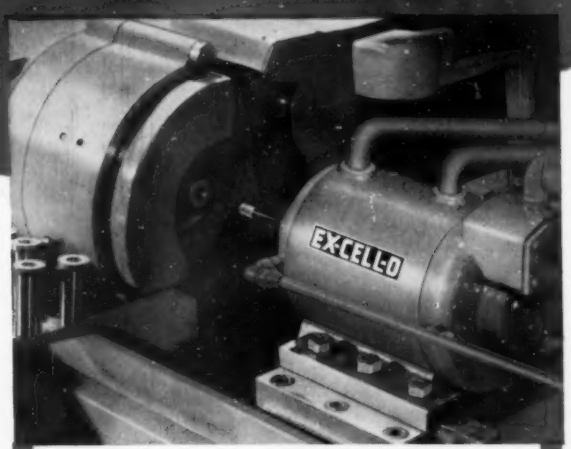


25,000 rpm high frequency inbuilt motor spindle.

Precision inbuilt motor spindle for cutter grinder.

Totally enclosed inbuilt motor surface grinder spindle

Heavy duty motorized precision spindle available up to 20 hp.



EX-CELL-O High-frequency Spindle, rated at 40,000 rpm, grinds small holes in bushings.

XLO

EX-CELL-O for PRECISION

For production grinding to precision limits "just any spindle" won't do. It must be carefully selected to suit the work. From Ex-Cell-O's widely-varied line of precision spindles you can select a standard model, or we'll make one special to your requirements. These spindles have long been the original equipment choice of leading manufacturers.

Features of the line include:

Rigidity
Permanent adjustment
No vibration, no chatter
Precision ball bearings preloaded for predetermined speeds

Phone your Ex-Cell-O representative, or phone or write Ex-Cell-O in Detroit, for CATALOG LISTING HUNDREDS OF STANDARD GRINDING SPINDLES

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

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SIMPLE OR INTRICATE SMALL PARTS

5/16-in. long, 6-32 brass machine screw with slotted head produced at the rate of one every 1-1/4 seconds (48 per minute).

Petcock valve body machined from 7/16-in. square steel stock—turned, formed, two threads, and tapped—total time, 26 seconds.

Model 48 B.S.A., 1/2-in. capacity single spindle automatic, splash guards removed to show screw slotting attachment to which part is automatically transferred after cut-off following threading with NAMCO Vers-O-Tool.

B.S.A. single spindle automatics are designed for a wide latitude of machining operations with standard attachments. Thus maximum operating flexibility is maintained at all times to insure trouble-free continuous high volume output. Productive capacity includes those parts that require the most intricate automatic machining.

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